THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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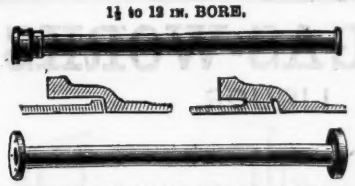

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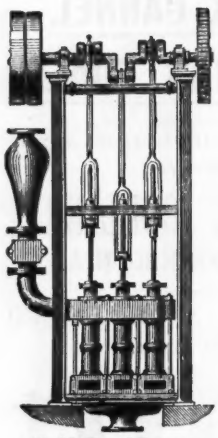

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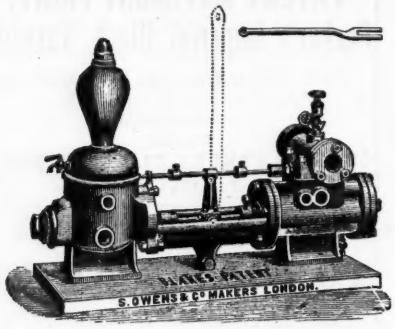

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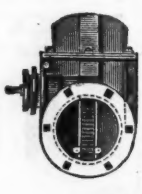

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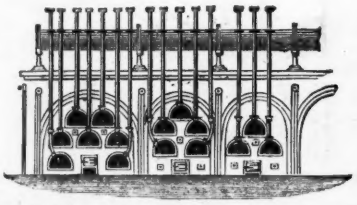

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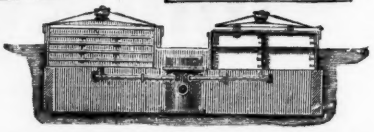

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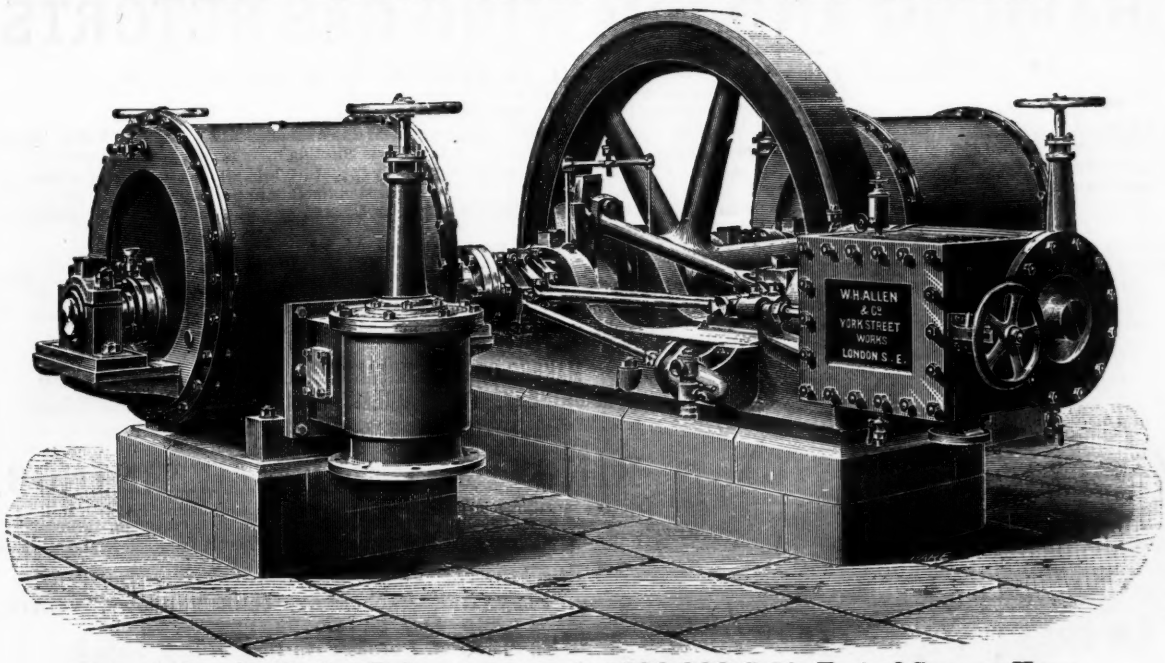

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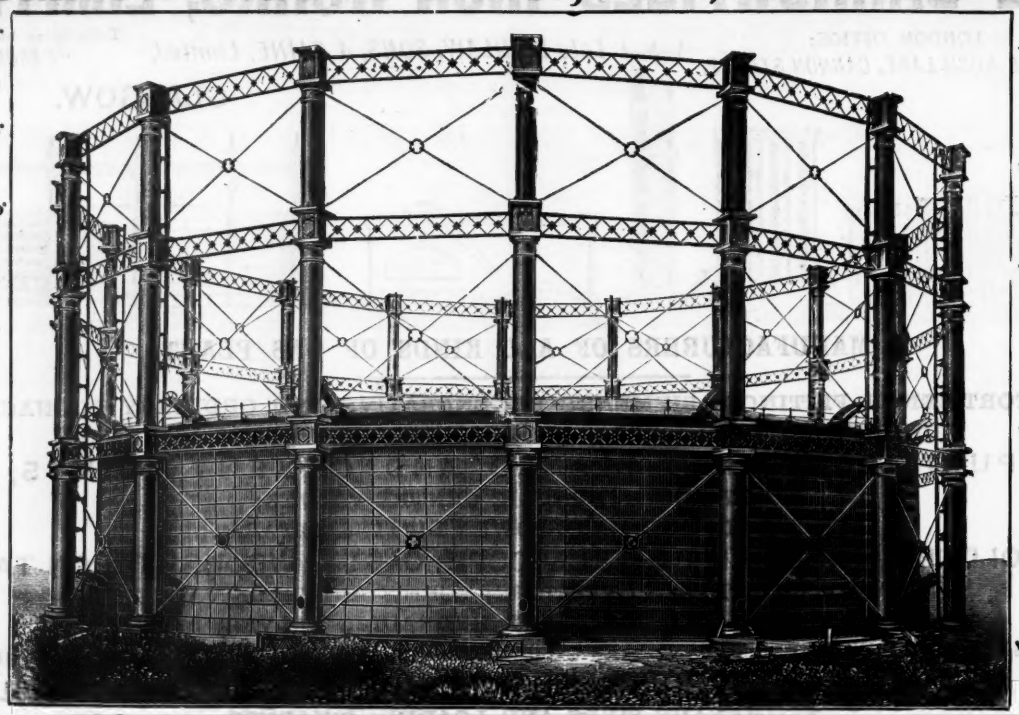

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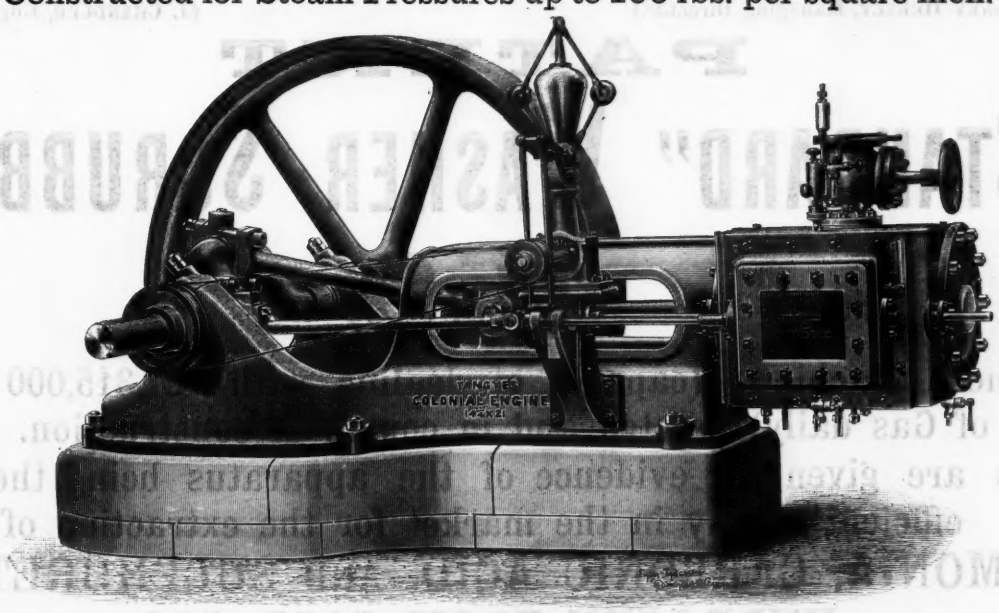

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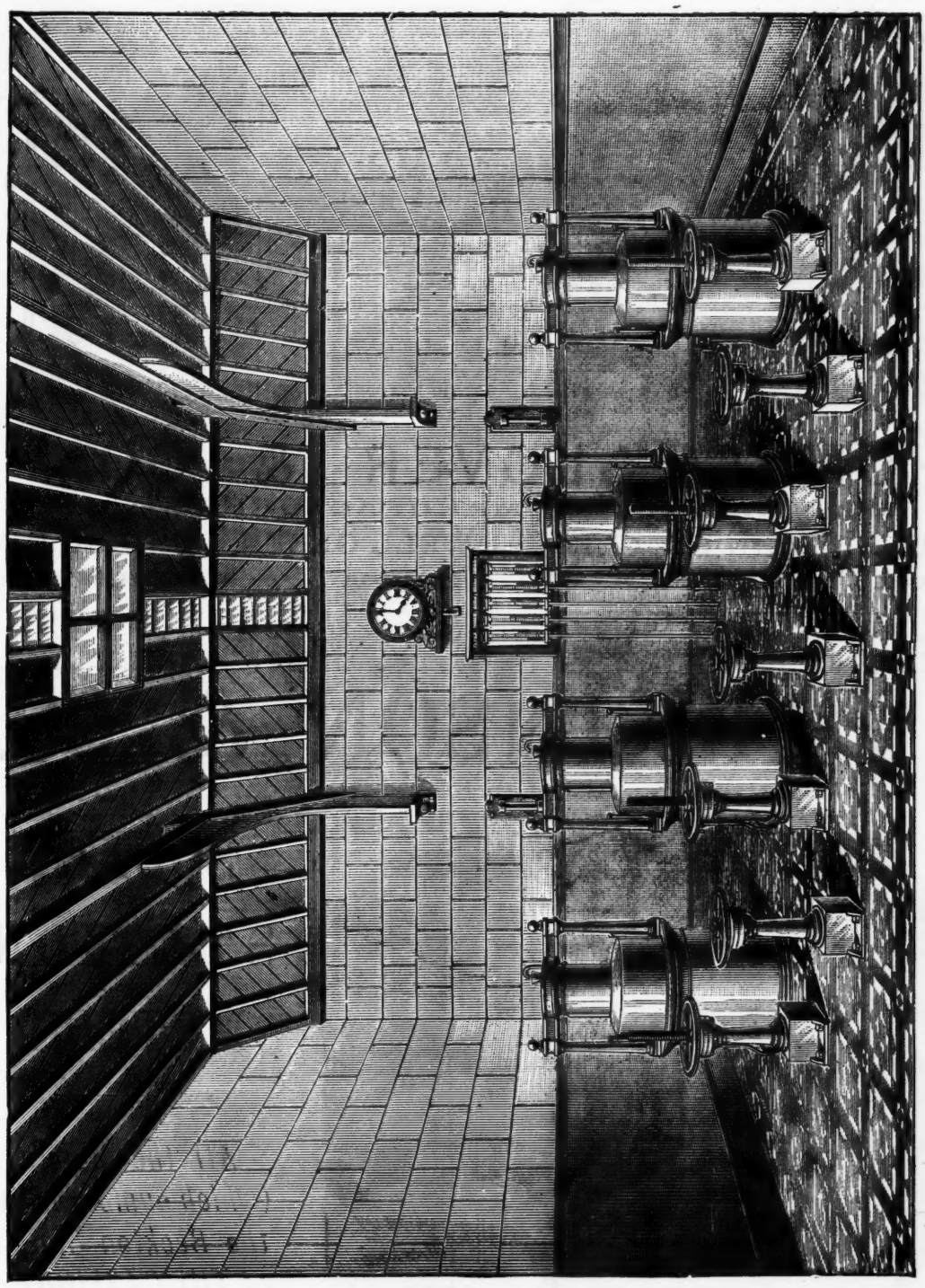

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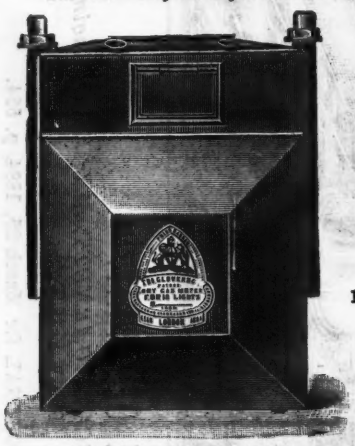

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[See also Advt., p. 164.

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TUESDAY, JANUARY 24, 1893.

The Gas Supply of Paris—A Revolutionary Proposal.

WHEN last mentioning the gas affairs of Paris, upon the occasion of the breakdown of the negotiations for renewing the Treaty between the City and the Gas Company, which expires in 1905, we ventured to express the opinion that the matter would soon be taken up again. As will be seen by a statement appearing in another column, this anticipation has been justified. At the meeting of the Municipal Council immediately after Christmas, M. Sauton, on behalf of the Committee who have had charge of the negotiations with the Company, moved that the matter should be expunged from the orders of the day, on account of the claim raised by the Company to the ownership of the distributing plant. At the same time, M. Sauton offered the suggestion, for the first time in the history of the controversy between the Municipality and the Company, that the best way out of the difficult pass in which the *question du gaz* stands at present would be the purchase of the Company's rights by the Municipality. The speaker cited the example of Birmingham in this respect, and observed that there is no reason why Paris should not do what Birmingham has done. How the undertaking is to be administered after the transfer—whether as a department of the Municipality or let under lease—is declared to be an after-consideration. "The "capital point," said M. Sauton, "is that the City of Paris "will resume her liberty of action, and the gas supply will "be administered in the general interest of the population." The speaker concluded by submitting a resolution calling upon the Executive to "draw up and submit to the Council, "early in the next session, a scheme of resumption by the "city of the exploitation of the municipal monopoly of gas "supply." It will surprise no student of French public manners to learn that this revolutionary proposal was received with loud applause, and was put to the vote and carried without a dissentient or inquiring voice.

Truly, the Frenchman in politics appears to act strangely, not to say fantastically, to our English judgment. We do not make this remark in any disagreeable spirit; but merely state the fact. It must have occurred to every English gas engineer who has followed with our help the tortuous progress of the Paris Gas Question, that the quickest, fairest, and safest way out of the tangle into which the matter has twisted itself would be for the Municipality to buy out the existing rights of the Gas Company under the present Treaty, and start afresh, either on the conclusion of the purchase, or in 1905. Years ago, however, when some such suggestion was made, it was quashed at once by the citation, on the part of somebody, of the mouth-filling generality that "the municipal "management of gas supply was repugnant to the genius of "the French people." The phrase was accepted at once, without any question, as settling that line of suggestion, which has consequently been religiously kept out of all subsequent discussions of the difficulty; for, whatever else may be treated irreverently in modern France, a catching, irrational platitude is safe from sacrilegious hands—at least, for a season. A time comes, as in the case under notice, when the "fine old crusted" platitude is set aside, without excuse or apology; so that an impartial observer of passing events has to rub his eyes, and wonder whether it can possibly be true that an "eternal principle" which has been held as of sovereign potency for so long, has thus been swept away without anybody offering a remark to indicate that it ever existed. It is in these things that one can see the manifestation of that essentially French spirit which "revolutionizes, but does not reform." A people who can depose a ruling principle, discovered and enunciated by themselves, with such light-hearted *insouciance*, shows by this act how it could change a dynasty between breakfast and dinner, without detriment to the enjoyment of either.

However, the plunge has been taken; and now the Paris Municipality stand committed, not merely to frame a scheme for purchasing the rights of the Gas Company in their undertaking, but also to base their project upon the Birmingham precedent. This remarkable circumstance alone would justify us, if justification were needed, for bestowing so much attention upon the Paris Gas Question as we have done during the past few years. Gas engineering, in its higher branches, is becoming more and more a cosmopolitan profession as time goes on; and we owe it to our readers all over the world to keep them in touch with the various developments of the industry in every land. With regard to the Parisian affair, all that need be said is that if the Paris Municipality approach the problem of transfer with as businesslike a mind and as equitable a spirit as the Birmingham people exhibited in their own operation, and if, when the purchase is completed, the Municipality administer the undertaking in the best interests of the inhabitants of the City, there is no reason why the consumers and the public generally should not be as well satisfied with the result as are the populations, not only of Birmingham, but also of Glasgow, Belfast, Edinburgh, and other cities that might be named. If, on the other hand, the Municipality merely think to get the better of the Gas Company, and only covet the

undertaking as a means of raising revenue, they must not expect that the way will lie smooth before them. Meanwhile, we have no fear for the Gas Company; it is well able to take care of itself.

The Dividends of The Gaslight and Coke and South Metropolitan Gas Companies.

It has been announced that The Gaslight and Coke Company will be in a position to pay a dividend for the last half year after the rate of 12 per cent. per annum; and that the ordinary general meeting will be held on the 3rd prox. We learn also that the South Metropolitan results for the same period are so good that not only will the dividend be paid out of the earnings, but there will be a balance of some £15,000, out of which the "shortage" of the June half year will be repaid; leaving still £6000 to the good. All this goes to show that the Metropolitan gas industry has not been unprosperous during the latter half of 1892; but, of course, the publication of the Companies' accounts must be awaited before it can be ascertained how the profits have been made. We notice that a financial newspaper, commenting upon The Gaslight and Coke Company's announcement, remarks that gas consumers in the Metropolis have good cause to regret that the dividend is not to be more; the reason assigned being that, "when the "dividends go up, the Company must, under the sliding "scale, lower the price of its gas; when dividends go "down, it is entitled to raise the prices, and naturally it "does so." It is so far satisfactory to discover somebody, presumably not professionally connected with the gas industry, accepting the principle that high dividends under the sliding scale are not incompatible with good circumstances for gas consumers; but the curious "cart before the "horse" way in which the comment is framed is not to be overlooked. Anybody would think, from this passage, that Gas Companies working under the sliding scale have it in their power to make their dividends according to their own fancy, provided that they do not forget the consumers. There are, however, more glaring mistakes than this in popular ideas respecting the principles of gas-works administration; and so we will let it pass.

The Sulphur Troubles of the South Metropolitan Gas Company.

The South Metropolitan Gas Company had a bad time of it last week, when the penalties for their excesses of sulphur during the summer were duly imposed by the Magistrates before whom the proceedings came, in accordance with the statute. Our reports, which will be found in another part of the Journal, give the bare legal outline of the cases; but we are in a position to explain the circumstances a little more fully here. The Company's formal plea of guilty was inevitable, in view of the fact that the real judicial officer in proceedings of this kind is the Chief Gas Examiner; and since they had failed to convince him that their transgressions against the law were excusable, and it was solely upon his report that the Magistrates were called upon to act, all they could do in Court was to plead, in mitigation of penalty, such extenuating circumstances as might be found in the facts. Having regard to the curious infelicity of newspaper reporters in dealing with the points of a case arising out of gas supply, it is hardly to be wondered at that the abstracts of the proceedings at the Southwark Police Court which appeared in several of the daily newspapers should have been altogether misleading. Mr. Frank Livesey, the Chief Engineer of the Company, had to explain to the Court that, in consequence of the Durham miners' strike, it had been necessary for the Company, who depend mainly on Durham coal, to get supplies from other available sources. He enumerated various descriptions of coal as having been obtained; concluding with the remark that he had even had some coal from Germany. When this mixed stock came to be carbonized, it was discovered that the proportions of sulphuretted hydrogen and carbonic acid contained in the crude gas were so different from what the station managers had been accustomed to, and the purifying plant had been designed to deal with—that is, the Durham standard—that the sulphiding arrangements were thrown out of gear; and the consequence was that the bisulphide of carbon failed to be arrested. This is the long and the short of the whole matter. As Mr. Livesey told his story, however, the ears of the reporters, not particularly well attuned to follow an explanation involving mention of chemical and engineering terms, caught the words "German coal," and they summed up the matter in the statement that the South Metropolitan Company had been fined heavily for selling impure gas made from German coal. Thus is history written. As a matter of fact, the Company never had more than two cargoes of German coal, which was bought as an experiment; and the entire quantity of such coal carbonized was as a "drop in the "bucket" to the ordinary consumption. Moreover, it does not appear the German coal was one whit more refractory in the purifiers than any other of the strange brands which had to be turned into gas containing less than 17 grains of sulphur per 100 cubic feet. Of course, a case of this kind is likely to be regarded differently by a practical gas manager and a member of the general public, or even a man of purely chemical training. Observers of the latter classes would be apt to say that a Gas Company must fulfil the legal obligations as to the purity of the gas sent out, irrespective of the character of the coal. If the management ventures upon strange coals, that is its private affair, and must be undertaken at the Company's risk. Legally, this is the position; and the Magistrates who have penalized the South Metropolitan Company had no option in the matter. Practical gas managers will sympathize with the Company, because such of them as practise sulphur purification are well aware how essential to the production of a constant result in this operation is the use of a material of uniform quality. Whatever may have been the description of coal which upset the South Metropolitan purifiers last July, there is no doubt that, after a little experience by the station managers of its peculiarities, the sulphur difficulty could have been overcome—and was so, in point of fact. But, meanwhile, the offence against the law had been committed. Metropolitan gas makers have no margin in which to disport themselves. The slightest stepping aside from routine lands them in trouble. There are gas-works in the country in which all sorts of coal are carbonized indifferently; but these works are not subject to the rule of the Referees.

Gas-Testing under the Gas-Works Clauses Act, 1871.

In another part of the present issue of the Journal will be found a special report of the proceedings at the Stratford Police Court on the 14th inst., when the Lea Bridge District Gas Company were fined ten guineas and costs for supplying gas of deficient illuminating power. The case, which was briefly mentioned last week (p. 114), is of such peculiar importance to all Companies supplying gas under the provisions, as regards testing, of the Gas-Works Clauses Act, 1871, that it is certain to be keenly discussed throughout the country, with what conclusion may easier be surmised than expressed here in words devoid of offence. The facts are few and undisputed. Mr. Leo Taylor, the duly-appointed Gas Examiner to the Walthamstow Local Board, made a test of the Lea Bridge District Company's gas on Oct. 29 last, and again on Nov. 2; in both cases finding the illuminating power below the statutory limit of 14 candles. He tested according to the letter of the Gas-Works Clauses Act, which says nothing about corrections for barometrical pressure and atmospheric temperature. If these corrections had been made, the gas would have shown an illuminating power in excess of the requirements of the Local Act; but, notwithstanding all that was advanced by the Company's witnesses as to the usual practice in this regard, the Magistrates held that such corrections are not necessitated by the terms of the Act of 1871. In arriving at this decision, the Bench probably followed the argument of Mr. Otto Hehner, which was that "the consumer buys the gas under the pressure "that may exist at the time. The testing is for the pro-"tection of the gas consumer; and it is unreasonable to "force an article with a correction upon him, if he has no "allowance made for that correction." Of course, there were complications in the case as it was presented to the Magistrates; there always are these subsidiary points, which tend to obscure the main issue. Thus, there was some dispute as to whether the testing apparatus was in proper order; and a point was made by the Chairman against the Company that, while they contended that barometrical pressure should be taken into account by the testing officer, as a matter of fact no barometer was provided by them. The only real question for the Bench, however, was as to whether the testing provisions of the Gas-Works Clauses Act, 1871, contemplate correction of the result of photometrical observations for atmospheric

temperature and pressure. The point is very clear; and the Magistrates, while admitting that the question is one of doubtful interpretation, have held that "they could not "import any other apparatus or process into the matter "than was required by the Act." The first thing that strikes a reader of these proceedings is a feeling of wonder that such a simple point of law has not cropped up before. Every gas manager knows that, in order to obtain photometrical results which are worthy of being compared with one another, corrections for temperature and pressure must be made; and it has been generally assumed that no photometry worth the name could exist without making these concessions to the physical nature of the gas examined. Gas is not like coke or potatoes, which can always be trusted to fill a measure reliably under all atmospheric variations. It is an essentially sensitive fluid; and whoever speaks of it with regard to its physical qualities does so subject to the qualification —implied, if not expressed—that he refers to it under its standard conditions of temperature and pressure. But, says the Stratford Bench, the consumer has nothing to do with this; and the gas must satisfy the legal requirement as to illuminating power in the condition in which it is sent out of the works. In other words, the Gas Company must make all necessary allowance for the effects of atmospheric temperature and pressure. This may be law; but, if so, it would be as well to have the matter settled by a higher authority than that of the Magistrate sitting at Stratford.

Frost Effects.

THE experiences of householders during the recent prolonged and severe frost in regard to frozen-out water-pipes have been in many cases painful in the extreme. We referred in this column last week to the free recourse which managers of theatres and concert halls have had, during the severe spell of cold weather, to the gas-burners, for the purpose of warming these generally very draughty interiors. That pleasing writer upon the trifles of every-day life, Mr. Ashby Sterry, has taken the opportunity for saying a good word for gas in the house, and has pointed out, in a widely-circulated weekly illustrated newspaper, that, by a little prudent management of intelligently-placed gas-burners, much of the worst effect of sharp frost upon water-pipes can be prevented. These are little hints which are likely to go far with the general public. At the same time, it must be confessed that the large-flame oil-lamps now so popular are a grave menace to the conventional gas-fire. They are portable and inexpensive; and, but for the trouble their inoffensive working entails, the heating efficiency of these modern types of oil-lamps would lead to their adoption for many uses now served by gas heating-stoves. This consideration should weigh with Gas Companies, and be an additional reason for selling gas as cheaply as possible. Even well-to-do householders and shopkeepers are apt to take alarm when the gas bills for the Christmas quarter come in; and the forgotten days when the gas was burnt from early morning until late at night, for the sake of its warmth, are found to have left their traces upon the dials of the meter. With the oil-lamp, on the contrary, all expenses are usually defrayed as they arise; and consequently they leave no sign. It is one thing to send out for oil as it is wanted, and pay for it by the shillingsworth, and quite another matter to have the equivalent expenditure for gas mechanically scored up against the day of reckoning, which may be deferred until street stand-pipes, skates, and other reminders of a hard season, are stowed away, and "out of sight" becomes in this regard "out of mind" also.

WATER AND SANITARY AFFAIRS.

DR. E. FRANKLAND'S monthly reports on the London Water Supply are now of much greater length than formerly, and contain a variety of information considerably exceeding that which was given less than a year ago. Last May, at the request of the associated Metropolitan Water Companies, the monthly examinations were extended so as to include the chemical and bacteriological conditions of the raw river water at the intakes, and the bacteriology of the water as it issues from the filter-beds. The plan is a good one, and bears evidence to the desire of the Companies for such an examination of the water as shall yield conclusive results. It was following on these investigations that Dr. Frankland, in his report for last July, spoke in such emphatic terms as to the effect of filtration "through "a few feet of sand." Of course, as recently pointed out by Mr. Crookes and Dr. Odling, there are circumstances connected with the presence of winter which prevent the low proportion of organic matter observable in the water supply of summer being maintained. Dr. Frankland's reports now illustrate this state of things. But, while natural causes become less favourable, artificial processes are in operation which modify their effect in a very material degree. In reporting last week concerning the December supply, Dr. Frankland says: "Contrasted with the raw river water, the supplies of the "five Companies drawing from the Thames showed a "chemical improvement of 19 per cent., and a bacterial "improvement of 99·99 per cent." We hardly know how this figure is worked out, taking the average of the five Companies. But 112 microbes per cubic centimetre in the supply would show a reduction of 99 per cent. compared with the raw river water; whereas the West Middlesex supply showed only 10, and the Chelsea as few as 3 microbes per cubic centimetre—the highest being 292 in part of the Southwark supply. The raw river water of the New River cut contained 3500 microbes per cubic centimetre; while the microbes of the Lea at the East London intake were as many as 15,000 in the same measure. But the microbes of the supply were as few respectively as 140 and 134. Dr. Frankland observes that "on the whole, there has been an enormous "increase of microbes both in the raw and filtered waters." But there was a broad margin for this increase, in addition to which the Chelsea and West Middlesex Companies are mentioned as "maintaining a very high degree of bac-"terial purity" in their supply. It is singular that these Companies gave even a somewhat better supply in the past month than in November, according to the bacteriological standard. So far, this shows what can be done; and certainly in no case did the Metropolitan Water Supply contain such a proportion of microbes as could furnish any real ground of complaint. As for the degree of purification, it was decidedly remarkable. In all cases Dr. Frankland reports the supply as "efficiently filtered before delivery."

It is to be regretted that General Scott's report comes to hand so long after date. The last report, giving the particulars for November, only reached us in the present month. It contains an interesting table, almost graphic in its style, furnished by the Chelsea Company, showing the condition of the River Thames on each day in November, and the period during which the Company were enabled to close their intake. Only on one occasion was the river as low as summer level. But on all the days when the state of the water in the river was "indifferent" or "bad," the intake at West Molesey was closed; and these days were seventeen in number. This doubtless helps to explain the circumstance that the Chelsea supply in November contained only 4 microbes per cubic centimetre. The Kent wells sometimes have more than that. General Scott cites the Chelsea table as illustrating the advantage derived from having large storeage reservoirs, and considers no Company properly equipped unless possessing reservoirs of sufficient capacity to provide for the closing of the intake while the river is fouled by storm water. This is said, while the Grand Junction Company are mentioned as having extended their filtration works, and introduced a system of double filtration which has been "markedly "beneficial." Shutting out flood waters and multiplying filter-beds are the grand conditions laid down by General Scott. For all such good works the Water Companies receive not the slightest encouragement from the London County Council. A document issued by that body last Saturday says something indirectly for the Companies. In the report of the Fire Brigade Committee, Captain Simonds states that, during the year just expired, there were five cases of short supply of water, and three of late attendance of turncocks. We may mention that the fires exceeded 3000—an unprecedented record. The report goes on to say: "As long as the supply of water is inter-"mittent in the Metropolis, difficulties must occasionally "arise. But each year the area under constant service is "increasing; and the cases in which the water arrange-"ments are unsatisfactory show a proportionate decrease." The extension of the constant supply is a matter for which credit is exclusively due to the Companies.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

For Stock and Share List, see p. 134.)

THE week just concluded has produced a fairly well-marked mprovement in the general position of business in the Stock iMarkets. After a somewhat hesitating opening, a better feeling prevailed, and transactions became more free. Aided by the easy condition of the Money Market, and the prospect of a possible reduction in the Bank rate, the demand for high-class securities for purposes of investment received a fresh fillip, and prices advanced accordingly; while a good effect generally was produced by affairs on the Continent (which had been threatening some degree of embarrassment) having taken a more favourable turn, and by the declaration of certain railway dividends at rates better than had been expected. In the Gas Market, the general advance in the position of the leading stocks—the probable advent of which we lately adverted to—is now an accomplished fact. By steady and moderate degrees, the prices of all of them are mounting up; and their restoration to public favour is proceeding merrily. Business has been good throughout the list. Gaslight "A," starting at the best figure of the previous week, gained additional strength as it went on—marking 229 on Thursday. After a free rise, there almost invariably sets in a disposition to realize profits; and therefore a temporary check to progress should always be borne in mind as among the probabilities of the immediate future. The demand for gilt-edged securities has still further advanced the debenture and preference issues; and the 4 per cent. debenture is now a choice article, which can only be bought to return 3¼ per cent. for money. The Directors, in making their usual dividend announcement, content themselves on this occasion with the bare notification that the rate will be 12 per cent., as before, and make no statement as to any balance carried forward; leaving the public to await the issue of the accounts. South Metropolitans have been extremely quiet; and the only feature is a further rise in "A" and "B." Commercials, after long inactivity, have roused themselves, and are on the upward march with the rest; the old stock marking a rise of 4, with business done at 240. Suburbans and Provincials have not yet fully participated in the rise; the only advance to date being in Brentford new. The Continentals are in full cry; Imperial and Union being especially run after. Undertakings in the more distant parts of the globe are unmoved. The advances effected by the Water Companies are extraordinary. Prices far in excess of any quoted for a long time past are now ruling; but so firmly are stocks being held, that even they cannot tempt many to sell.

The daily operations were: At the opening on Monday, the upward tendency in Gas was at once apparent. Imperial Continental rose 1½; Continental Union, 2; ditto, preference, 1; and Gaslight "H," 1. Water also advanced; East London, Grand Junction, Southwark, and West Middlesex gaining 1 each. Progress continued on Tuesday. Gaslight 10 per cents. went up 1; and 4 per cent. and 4½ per cent. debenture, 2 each. In Water, Chelsea and Lambeth rose 2; and East London, 1. Wednesday was equally favourable. Commercial old gained 2; Gaslight "A," 1¼; and Imperial Continental, 1. In Water, Chelsea and Southwark rose 3 each; Lambeth and Kent, 2 each; and East London, 1. Thursday was similarly strong. Brentford new advanced 2; Continental Union, 1; ditto, preference, 2; Imperial Continental, 1½; and South Metropolitan "B," 1. Kent Water rose 2; and East London, Lambeth 7½ per cents., and West Middlesex, 1 each. A lull was apparent on Friday; the only move being a rise of 3 in Lambeth Water. The advance was resumed on Saturday. Commercial old gained 2; Continental Union, 1; Gaslight "H," 1; and South Metropolitan "A," 1. Chelsea Water rose 2; East London, 1; Kent, 2; Lambeth, 2; ditto, 7½ per cent., 1; New River, 2; Southwark, 3; ditto, "D," 2; and West Middlesex, 2.

ELECTRIC LIGHTING MEMORANDA.

Dr. Hopkinson and the Three-wire System—The Extent of Central Station Lighting in London—Boot Warming by Electricity.

THE event of the hour in electrical engineering circles is the victory of Dr. Hopkinson over the St. James's and Pall Mall Electric Lighting Company, and the upholding of the patent for the three-wire system of distributing electricity. This is the result of one of the most important patent suits of recent times; and the judgment is one from which patentees of all orders will take much comfort. There was no haphazard about Dr. Hopkinson's invention. It was a case, of a class not so numerous as might be wished, where the inventor knew from the outset what he wanted to do, and did it effectually. The patent was taken out for something the nature and operation of which were perfectly clear to the patentee, and, after the patent specification was published, to everybody interested in the subject-matter. There was no suggestion that later knowledge put a value upon the phraseology of the specification not thought of by the patentee, which is one of the most fruitful sources of patent litigation. The introduction of the three-wire system of distributing electricity came at a critical era of the development of electric lighting; enabling incandescent electric lamps connected in parallel to preserve a uniform brilliancy irrespective of the number turned on or off, and at the same time greatly reducing the weight of copper required for the main conductors. As soon as the system was made known, it appeared so simple to experts in the matter that it was pronounced obvious; and the inevitable consequence followed. The patent was infringed, its validity denied; and the patentee was left to take what remedy the law could give him. For once justice and law seem to have been on the same side; and so the meritorious patentee has gained the relief he sought. The problem that now arises is as to what amount of compensation the St. James's Company owe to Dr. Hopkinson.

With the issue of the *Electrician* for the 13th inst. there was given a coloured map, showing the extent to which the distributing mains of the different Metropolitan Electric Lighting Companies were carried up to the close of the past year. The map was explained by a well-informed article setting forth the character and volume of the work done at the various central lighting stations. The progress of electrical supply in London during last year is described as having been more in regard to lamp connections than in the laying of new mains; which is so far satisfactory to the companies. Reckoned as 8-candle power units, the total number of lamp connections at the close of the year is given as 503,902. It appears that the companies are painfully gathering experience of the matters which are of such vital importance to them—the proportion of the actual demand to the possible maximum consumption, and the number of lamps to be secured per mile of main. A tabular statement relating to these and other data of central station lighting appeared as a supplement to the *Electrician* for the 6th inst.; and our other electrical contemporary, the *Electrical Review*, has published similar information. We gather from these statistics that the central electric station is lucky that employs as much as one-half of its productive power at any one time, some of the London companies having to be content with a load of only one-quarter or one-third of the possible demand. If this proportion could be relied upon to hold good for all time, it follows that a central station would serve double or treble the number of lamps for which it has the plant. But then, what a waste of distributing power this condition implies! More plainly than ever does the experimental character of all central station lighting enterprise appear from these statistics. It is impossible to predict, with reference to any given district, how the mains should be run so as to secure the best result in lamp connections per mile; and the most economical apportionment of capital to generating and distributing plant is likewise a secret of the future. Commenting upon the conditions of electrical supply revealed by its own tables, the *Electrician* remarks that the companies are not only "burdened for the present with spare plant, but a large expenditure of capital for mains in the streets has been incurred; and this is only partially utilized." This is as much as to say that the companies concerned have a good deal to go through before the commercial adaptation of means to the end desired will be as perfect as the engineering arrangements.

We are quite used to the advocacy of electric lighting upon grounds other than the mere sordid consideration of light obtained for money spent. It is the commonest of newspaper commonplaces that, although electric lighting may be costly in itself, it is capable of bearing untold economies in whitewash and matches. We have endeavoured to swallow the argument that, because electric lamps are so easily switched on and off, they are never likely to be turned on wastefully, or left alight when not wanted. Experience of gas-stoves, however, with their liability to be turned on for utterly insufficient reasons, has made it difficult for us to digest the latter fancy of the electricians. It is always pleasant, notwithstanding, to hear something said for electric lamps which cannot be controverted by the most stalwart believer in other illuminants; and therefore we gladly help to spread the news of a happy discovery to this effect, which has been announced in one of our electrical contemporaries. It is that "the sov'reignst thing on earth" for warming boots—an admitted comfort in frosty weather—is to put an 8-candle incandescent lamp into them while dressing! We are assured that this "great luxury" is not an expensive one. All that is needed, we presume, is convenient connections and a supply of spare lamps. If there is no fog at the time, it may be well, we are told, to "connect the lamps in series, since, if no other lamps are on, the meter will probably fail to start." Thus there is no trouble about the arrangement; and, barring accidents, the cost of warming a pair of boots for a week is not expected to attain the sum of one halfpenny. If the boots of a family are to be treated in the same way, the result may be different. It may be conceded at once that this is a perfectly unique recommendation of electric lamps, and one of the cleverest suggestions for increasing the popularity of electric lighting that has been heard of since Mr. W. H. Preece gave up lecturing upon the electric lighting of dolls' houses.

Sugg's Gas Engineer's Pocket Almanac and Lighting Table for 1893.—We have received a copy of this convenient pocket-book, which, as in former years, contains a number of useful tables, with blank forms for entering carbonizing and gas accounts, &c., and space for general memoranda. It is to be obtained of Messrs. W. Sugg and Co., Limited, whose various gas-testing and other appliances are fully illustrated and described.

PROVISIONAL ORDERS FOR 1893.

THE following draft Provisional Orders relating to gas and water supply have been deposited with the Board of Trade :—

The Bromyard Gas Order is to confer statutory rights upon the Bromyard Gaslight and Power Company, at present supplying gas within the town and parish of Bromyard and the parishes of Linton and Winslow, all in Herefordshire. The share capital of the undertakers is not to exceed £5000, of which £1000 is already raised, and is to constitute the original capital. The borrowed capital is to be limited to £2000, to bear not more than 5 per cent. interest without the consent of the Board of Trade. If the clear profits of the undertaking for any year are in excess of what is needed to pay the prescribed rate of dividend, such excess to the extent of 1 per cent. upon the paid-up capital is to be invested to form an insurance fund, the amount of which is not to exceed 10 per cent. upon the capital. Any balance of profit is to be carried to the credit of the divisible profits for the next following year. Power is also sought for the creation of a reserve fund out of divisible profits in excess of the standard rates of dividend, when such excess is due to selling gas below the standard price. Gas of 15-candle power is to be supplied at the standard price of 6s. per 1000 cubic feet. New gas-works are to be constructed. Interest at 5 per cent. is to be paid on consumers' deposits. The Hoylake and West Kirby Gas and Water Order is to enable the Company of this name to raise £10,000 of additional share capital, carrying the usual borrowing powers, for the purposes of their water undertaking. The Llanfairfechan and Aber Gas Order is to invest with statutory powers a private undertaker of gas lighting for the parishes named, in Carnarvonshire. The capital is to consist of the original sum of £5657 already expended upon the works, and additional capital amounting to £8000, with the usual borrowing powers. At the standard price of 5s. 10d. per 1000 cubic feet, 14-candle gas is to be supplied. All the capital is to carry 10 per cent. profit, with the usual sliding scale terms; and 1 per cent. extra may be taken to form an insurance fund amounting to one-twentieth of the capital. A reserve fund may be created out of excess profits payable under the sliding scale. No sale or assignment of the undertaking is to have any validity without the consent of the Board of Trade. The Newent Gas Order is to confer statutory powers upon the Newent Gas Company, Limited, whose capital is stated at £5000, all of which is original, and is to carry the usual borrowing powers. Insurance and reserve funds are to be formed in the manner already described in regard to other Orders. Additional land is to be acquired. For 14-candle gas, the standard price is to be 6s. per 1000 cubic feet. The Otley Gas Order is to amend and extend the Otley Gas Order of 1889, by enabling the undertakers referred to in this Order to acquire additional lands, and to supply gas in bulk beyond their limits of supply to any public authority or authorized gas company. The borrowing powers are to be enlarged by the sum of £2200, so as to enable the sale of gas in bulk to be carried out. The Portishead Gas Order is to empower the Portishead Gas Company, Limited, to carry on their undertaking with statutory facilities. The limits of supply are to be the parishes of Portishead, Portbury, Clapton Easton in Gordano, or St. George and Weston in Gordano, all in Somerset. The capital is not to exceed £25,000, comprising the £10,000 of original capital already issued but not yet fully called up, and additional capital amounting to £15,000, to carry the usual borrowing powers. Insurance and reserve funds are to be formed in the manner already described. Additional lands are required. Clauses are inserted for the protection of the Great Western Railway and the Western Tramways Company. Gas of 14-candle power is to be supplied at the standard price of 5s. per 1000 cubic feet. The Sheffield Gas Order is to empower the Sheffield United Gaslight Company to extend their works, and to create and issue debenture stock to the amount of £200,000, bearing 4 per cent. interest, and offered to the public under the auction clauses. Not more than £50,000 of such stock is to be issued at once, or at shorter intervals than six months; and no lot is to be of greater nominal value than £500. It is desired to alter the standard burner in use for testing the gas in favour of a Sugg's "London" Argand No. 1, with 24 holes, each 0·045 inch diameter, with a chimney 6 inches long and $1\frac{7}{8}$ inches diameter. The nominal illuminating power of the gas is correspondingly altered from 15 to $16\frac{1}{2}$ candles. Interest at 5 per cent. is to be paid on deposits; and dividends remaining unclaimed for twelve years are to be declared forfeitable to the revenue account for the time being. The Sligo Gas Order is to empower the Gaslight Company of Sligo to raise £6000 of additional capital by the issue of new ordinary or preference shares or stock, and to borrow £1500. The new capital is to carry an 8 per cent. ordinary or 5 per cent. preference dividend. No share capital is to be raised by borrowing on mortgage, nor is borrowed money to be converted into share capital. Permission is sought for selling gas in bulk. The supply of 15-candle gas at the standard price of 5s. 5d. per 1000 cubic feet is proposed; and interest at the rate of 5 per cent. is to be paid on consumers' deposits. The Swindon Gas Order is to confer statutory powers upon the Swindon Gas and Coke Company, Limited. The district of supply is defined as comprising the whole of the district of the Old Swindon Local Board and part of the area covered by the Swindon New Town Local Board. The capital of the Company is fixed at £20,000, of which £12,000 is original capital already authorized and raised, carrying the usual borrowing powers. Insurance and reserve funds may be formed. Additional lands are required, and the works are to be enlarged. For 15-candle gas the standard price is suggested of 4s. 6d. per 1000 cubic feet. Clauses are inserted giving power to supply gas in bulk; to refuse supplies to persons in debt for other property; to limit the period of error in defective meters; and requiring 5 per cent. interest to be paid upon consumers' deposits.

The Llandrindod Wells Water Order is to empower the Company so-called to raise £2000 of additional 7 per cent. share capital, and to borrow £500. The Maidenhead Water-Works Order is to enable the Company to extend their limits of supply so to include the parish of Hurley and the portions of the parishes of White Waltham, Wargrave, Ruscombe, Broad Hinton, and Whistley in Berkshire as are situated northward of the main-line of the Great Western Railway. It is desired to raise £10,000 of additional capital, and to borrow £2500 in regard to the same. The Newington Water Order is to enable the Newington Water Company to raise £30,000 of additional 7 per cent. share capital—thus increasing the capital in the whole to £100,000—with the usual borrowing powers. Additional lands are to be acquired and new works constructed, comprising a well and pumping-station, with the necessary pipe-line. A clause is inserted providing that, if in the opinion of the Cottingham Local Board of Health the supply of water to existing pumps in the hamlet of Dunswell in the district of the Local Board shall be diminished by the proceedings of the Company under this Order, the latter are to make good the deficiency. The Pocklington Water Order proposes to authorize the Pocklington Water Company to construct additional water-works in the parishes of Pocklington and Millington in the East Riding of Yorkshire, and to raise £1000 of new share capital carrying borrowing powers for £250. The new works are to comprise a collecting chamber in the parish of Millington; and from this chamber a 3-inch pipe is to be connected to the existing main of the undertakers in the highway leading to Pocklington. No more water is to be taken than will flow through this pipe—all the rest that may be collected being returned to the stream. The Poole Water Order is to extend the limits of supply of the Poole Water-Works Company to embrace a district which it takes upwards of a closely printed page to define, subject to the proviso that, if after six years the undertakers are not found to be furnishing a sufficient supply within the extended district or any part thereof, the local authority interested in the matter, or any company or person, may proceed to apply for an Order in respect of the locality as if the present Order had no existence. The sum of £20,000 is to be raised by the issue of new 7 per cent. shares or stock, with the usual borrowing powers. Additional works are to be constructed, comprising an engine-house and pumping-station at Longfleet, a water-tower at Broadstone in the parish of Canford Magna, another pumping-station and impounding reservoir in the Luscombe Valley, Parkstone, a gathering-ground at Alderney, and various subsidiary works. Clauses are inserted for the protection of the South-Western Railway. Water may be supplied by agreement in bulk outside the limits of the Company' subject to the prior claims of the consumers within the district. Power is desired to supply by meter at the Company's option—such meters to be kept in repair by the Company, and let out at a rental not exceeding 15 per cent. upon their cost. Arrangements may be made for the supply of water to vessels in the port of Poole. The South-West Suburban Water Order is to empower the Company of the same name to raise £50,000 of new capital, with the usual borrowing powers, and permission to create debenture stock.

The Borough of Bideford Provisional Order is issued in draft, under the provisions of the Public Health Act, 1875. It is an application by the Urban Sanitary Authority to the Local Government Board for sanction to an agreement for the transfer of the undertaking of the Bideford Gas and Coke Company, Limited, and for permission to carry on the supply. The gas is to be of 15-candle power; and the maximum price 5s. per 1000 cubic feet—discounts being permitted of 10 per cent. for prompt payment, and 20 per cent. for large consumption. Not more than 10 per cent. discount is to be allowed on the public lighting account. The money to be borrowed for the purposes of the Order is to be repaid in 50 years. If they think fit, the Sanitary authority may form a reserve fund by annual payments of not more than 10 per cent. of their gas revenue.

Institution of Civil Engineers.—At the December ballot, Mr. T. F. Ennis, Assistant Engineer at the Nine Elms station of The Gaslight and Coke Company, was elected an associate member.

Partnership Change.—Mr. Gilbert Little, Managing-Director of the New Conveyor Company, Limited, has been admitted as a partner in the private limited company of Messrs. Barry, Henry, and Co., engineers and ironfounders, of Aberdeen and London; and he has accepted the position of Managing-Director. His connection with the New Conveyor Company, however, remains unchanged; and the new fitting and turning shops recently erected by Messrs. Barry will be largely devoted to the manufacture of the various labour-saving appliances with which his name is associated.

NOTES.

The Mechanical Equivalent of Light.

It is known that Professor S. P. Langley has been experimenting for a long time upon the mechanical valuation of light effects. From the memoirs of the American National Academy of Sciences, it appears that these researches have lately taken the direction of investigating the correspondence between energy and vision in regard to luminous phenomena. Professor Langley was led to work upon this line by the fact, not generally recognized, that the same amount of energy may produce totally different effects in different parts of the spectrum. The nature of his experiments are fully described in the publication named; but it will only be necessary to reproduce here the results so far obtained. The energy required to give the bare impression of luminosity in various parts of the spectrum, expressed in terms of horse power, was found to be roughly as follows; the minimum visible being defined as the feeblest light which is observed to vanish and reappear when silently occulted and restored without the knowledge of the observer:—

		Horse Power.
Violet	(λ 400)	0·000000 000000 00018000
Green	(λ 550)	0·000000 000000 00000075
Scarlet	(λ 650)	0·000000 000000 00017000
Crimson	(λ 750)	0·000000 000000 34000000

These values were derived from observations made by a single observer, and are therefore subject to a large correction for possible error. The general result of Professor Langley's investigation goes to show that the time required for the distinct perception of an excessively faint light is about half a second. A relatively very long time is said to be needed, however, for recovery of visual sensitiveness after exposure to a bright light; and this time appears to be greatest when the light to be perceived is of a violet colour. The amount of energy required to make us see varies enormously according to the colour of the light in question, and considerably for different persons. From an average of four normal observers, however, it appears that, taking the amount of energy required to show a light in the extreme red end of the spectrum near A as unity, this will produce 14,000 times the visual effect in the orange portion, 28,000 times the effect in the yellow, 100,000 times in the green, 62,000 times in the blue, and 1600 times in the violet.

M. Le Chatelier on Fire-Damp.

M. Le Chatelier, Professor at the Ecole des Mines, and a member of the French Government Commission upon Fire-Damp, has recently published a memoir summing up and reviewing the existing stock of knowledge upon this subject. In discussing the nature of fire-damp, M. Le Chatelier criticizes the usual methods of obtaining samples and their analysis. He limits the sources from which samples should be taken to natural blowers and bore-holes in the solid coal. With regard to the examination of fire-damp, M. Le Chatelier thinks that the presence of less than 1 per cent. of foreign gases cannot be ascertained; and that it is only possible to be certain as to their presence when calculation shows their content to be at least 6 per cent. This is a matter of great importance in regard to the assumed presence in fire-damp of the more volatile and combustible gases derivable from coal. M. Le Chatelier dismisses all such assumptions, and concludes that hitherto marsh gas is the only combustible gas the presence of which normally in fire-damp has been definitely ascertained. If other gases should be found by future investigators, M. Le Chatelier thinks they are more likely to be heavy hydrocarbons, such as give their distinct odour to certain coals. As to the origin of fire-damp, the author thinks that its formation was certainly contemporaneous with that of the coal itself, since it is generally found associated with seams buried at a great depth under heavy and impermeable matter. This is a direct contradiction of the theory of continuous present decomposition of coal upon exposure to the atmosphere.

Coke from Powdered Coal.

Recent articles in the *Engineering and Mining Journal* have exhaustively discussed the subject of the methods of carbonizing coal by which the quality of the coke may be improved. It is concluded, from a review of all known "dry" methods of improving oven coke, that the only one that seems to be worthy of attention is the pulverization of the coal. A coke company operating 450 beehive ovens has found that grinding the coal to the fineness of meal has a remarkably beneficial effect upon the coke, not so much as regards its chemical composition, of course, as in structure, which is a most important consideration. Then, again, it has been observed that the coking quality of a coal is improved by fine crushing, which is effectual in the case of some coals that coke badly when carbonized as "through and through," or even as slack. This would be the case particularly with slaty or dirty coal, as the comminution of the particles would allow the bituminous ingredient to bind the mass more firmly together. Crushing does not remove any impurities from coal; and the effect of the operation is purely physical as regards the coke. But this is of importance in the market; and it means saving of waste in carriage. It is noteworthy that no record exists of the effect of pulverizing coal upon its gas-making qualities. Dust coal was formerly objected to by gas managers, mainly on account of the difficulty of keeping up retort heats with it. With the use of gas furnaces, however, there can be little force in this traditional objection; and where gas coke is a drug in the market, any practicable hints for improving its quality are not to be despised.

Mr. Tom Mann and the New Labour Department.—An offer has been made by Mr. Mundella, President of the Board of Trade, to Mr. Tom Mann, of an appointment on the new Labour Department. Mr. Mann has expressed his sense of the honour done him; but he has declined to entertain the proposal, on the ground that he can better serve the cause of labour as an outside worker.

Death of Mr. J. Siddall, of Cleckheaton.—The recent death is announced of Mr. John Siddall, who for a period of 30 years printed and published the *Cleckheaton Advertiser*. Mr. Siddall strongly advocated the formation of the Cleckheaton Local Board, which was carried out in 1863; the establishment of a system of water supply for the town, which was effected in 1866; and the acquisition of the gas-works, which was completed in 1870. He was in his 72nd year.

The Sanitary Institute Lectures.—The programme of the fifteenth London course of lectures and demonstrations for sanitary officers, to be delivered, under the auspices of the Sanitary Institute, at the Parkes Museum, Margaret Street, W., has been issued. The opening address will be given by Sir Douglas Galton, K.C.B., &c., on the 31st inst.—his subject being "Ventilation, Warming, and Lighting;" and the other lectures of the course will occupy the Tuesday and Friday evenings of February and March. The programme does not vary in any material respect from those of previous years.

The Deep Artesian Boring at Galveston, Texas.—In the JOURNAL for Oct. 11 last (p. 635), we gave some particulars of a deep artesian well in progress at Galveston, Texas. The water supply of the city is derived from 13 wells, varying in depth from 825 to 1350 feet; but as the quality of the water was found to be unsuitable for domestic purposes, it was decided to sink another to a depth of 3000 feet, at a cost of $75,000. At the time the matter was last noticed by us, the boring had reached 2920 feet; and it has now been carried to a depth of 3070 feet. Unfortunately, no rock has been penetrated; and the water supply sought has not been obtained. Further work has been abandoned; and the hope of obtaining a flow of fresh water on the island given up. Wells will, it is said, be sunk on the mainland 14 miles from the city, and water brought across the bay by iron pipes. The estimated cost for this work is $800,000.

Stamped Steel Coal and Coke Buckets and Chains.—The New Conveyor Company, Limited, have lately fitted up special plant for the production of chains and buckets of stamped steel for the conveyance of coke and coal. It is claimed that the machinery is the most powerful of its kind in the world, and enables the Company to turn out "stamped" buckets up to 40 in. by 24 in. of any thickness, and steel pitch-chains of any sized links. The links are stamped out so as to give large wearing surfaces; and thereby a chain of enormous strength is ensured. With the improved chains and buckets, or stamped trays, coal and coke conveyors of great durability can be produced; and, by means of a new form of self-tilting bucket, coke may be trimmed at any point in the yard, or into a range of waggons. A similar form of bucket-tray on the new steel chain is specially suitable for the conveyance of lime and oxide. We shall shortly be publishing illustrations of these and other appliances of the Company.

A Misleading Critique.—A few weeks since (as our readers may remember) the *Engineer* kindly undertook to teach gas engineers the elements of their craft; and, when called upon for an explanation of its remarkable utterances, feebly attempted to administer an ill-timed snub to the industry at large. We regret that another of our engineering contemporaries displays lamentable ignorance as to the magnitude of the gas industry of the United Kingdom. Commenting on the Parliamentary Returns recently issued, *Engineering* informs its readers that the quantity of gas produced by the gas companies last year amounted to about 70 million cubic feet, which is approximately a thousandth of the true amount, and considerably less than the winter daily production of one company alone. Really, if our engineering contemporaries are so incompetent to treat of gas matters as their recent comments indicate, they would best serve their own interests by abstaining from touching on them at all, or by contenting themselves with excerpts from reliable sources.

Gas-Stoves for Heating Churches.—By what seems like a strange oversight, no provision was made in the original design of St. Eugene's Cathedral, Londonderry, for the proper heating of the edifice; and the structural alterations which the introduction of any of the usual systems would have involved have hitherto deterred the authorities from making any attempt in this direction. Recently, however, as the result of a number of experiments carried out by Mr. E. J. Toye, twelve gas-stoves have been placed in suitable positions in the church; and they are found to diffuse through the building a comfortable, but nowhere excessive, warmth. The stoves are Messrs. R. and A. Main's No. 12, and are exceedingly simple in operation. When gas was suggested, great objection was raised to it on account of the unpleasant odours which it was feared would be thrown off; but the arrangement adopted leaves nothing to be desired in this regard. Moreover, the church can be properly heated in a shorter time than by the hot-air or hot-water system.

COMMUNICATED ARTICLES.

A FEW REMARKS ON THE POSSIBILITIES OF INCANDESCENT GAS LIGHTING.

By H. Leicester Greville, F.I.C., &c.

The JOURNAL of Dec. 6 contained a short notice of some recent improvements in the Welsbach Incandescent Gas-Light, which are pregnant with interest, as opening wide possibilities in this particular method of lighting. I am assuming that the statements put forward as to the extent of the improvements recently effected in the Welsbach system are true; but even making a large allowance for possible exaggeration, the question is of sufficient importance to justify more than a passing notice. It is claimed that the Welsbach burner of the future, while having a "mantle" of much greater duration than its predecessor—and therefore giving greater economy and less trouble with regard to this detail—will, in addition, afford a light of 19 candles per cubic foot of gas. This result, if true, would be unprecedented; and its full import can only be grasped by comparison.

The best regenerative burners of the most expensive type do not develop anything approaching this proportion of light to gas consumed; and they have the disadvantage, in most cases, of being less efficient on a small than on a larger scale, and also of requiring accurate adjustment of gas supply to develop their full capacity. All these considerations have much restricted their application, which has been limited mainly to larger lighting effects—private house lighting being mostly obtained by various burners of the ordinary types. The incandescent system has from the first had the advantage of possibly reaching the private consumer, by reason of the comparatively low price of the burner, proportionately to the light development per cubic foot of gas consumed. That the system has not been more widely adopted, must be attributed to the fragility of the mantles, and the necessity of their periodical renewal; and also to the inability of the average consumer to realize the fact that it is false economy in the end to buy burners at the lowest possible price, in place of paying more for a better article. Anything will do to burn gas; and if the light is inferior, it is the gas which is blamed, whereas it should be in many cases the inefficient appliance provided for light development. How many consumers realize that a penny gas-burner may afford a light of less than 2 candles per cubic foot, while the best class of light developers may afford five or six times as much, and, if recent statements be true, even a higher proportion? How many consumers ever take the trouble to balance increased value to be obtained from the gas, against interest on capital expenditure at, say, 5 per cent.? A very simple calculation will show that, in cases where a reasonable amount of gas is consumed per annum, 1d. capital expenditure and 2 candles per cubic foot is infinitely more expensive than £5 capital expenditure and 10 candles per cubic foot.

Turning more especially to the incandescent system of gas lighting, one particular feature about it which has always impressed me is the fact that (with proper appliances—such as mantle, burner, &c.) the light development is purely a function of heat. When once this fact is thoroughly realized, the future possibilities of the system offer a wide field for speculation. Moreover, the proportion of light-giving hydrocarbons in 16-candle gas, is comparatively small, and does not seriously influence its heating value. As a proof of this, I made the following experiments some years back with the old type of the Welsbach incandescent burner. An experimental holder was charged with gas, which, tested in the ordinary way, with the standard Sugg "London" Argand, at 5 feet, gave 17·3 candles illuminating power. The gas was tested in the Welsbach, and the result noted. The illuminating power was then reduced by passing the gas through a small scrubber, charged with coke soaked in colza oil, to absorb a portion of the luminous hydrocarbons; and tests were again made by the "London" Argand and the Welsbach. The following results were obtained:—

Experiment No. 1.

	Sugg "London" Argand.		Welsbach at 2·3 cub. ft. Calculated to 5 "
Original gas	17·3	..	28·2
Treated gas.	5·7	..	28·3

Experiment No. 2.

			Welsbach at 2 cub. ft. Calculated to 5 "
Original gas	17·4	..	35·2
Treated gas.	7·2	..	35·2

We see, therefore, that the abstraction of a large proportion of the luminous hydrocarbons from coal gas does not affect its value as a light developer in burners on the incandescent system; and consequently poor illuminating gas is practically of equal value to a richer material. Of course, it must be understood that this remark would not apply to a gas whose poorness was due to any alteration of composition which would seriously alter its heating value.

Turning to practical considerations of the above results, it is well known that a comparatively large item in the cost of producing ordinary coal gas is the necessity of maintaining a sufficient proportion of illuminating hydrocarbons to afford the light required to meet the statutory obligations imposed on the various companies. The coal employed for gas manufacture may give as low as 12 or 14 candle gas, as tested in the usual way; but this has, as a rule, to be brought up to a higher standard by the use of cannel or oil, which forms a comparatively expensive item in manufacture. Further, the mere fact of the gas having to be manufactured at a higher lighting value than is normally realized in practical carbonizing from the bulk of the coals employed, leads in many cases to a tendency on the part of the management not to push the extraction of the gas from the coals to its full limits, as the illuminating value would correspondingly suffer. A proportionately large quantity of more expensive materials has then to be used, to bring the gas up to the statutory lighting power required. So long as gas is consumed in burners in which the luminosity is due to the presence of light-giving hydrocarbons, this state of things must be perpetuated.

It has been already pointed out that the proportion of hydrocarbons in coal gas to which the light is mainly due is comparatively small; and the proportion in which they increase the heating efficiency, is even smaller. At the same time, while gas is perhaps likely to suffer from its rival electricity in the domain of lighting, it has a large and increasing sphere in the domain of heating—both for cooking purposes, for the development of mechanical power in gas-engines, and for domestic fires. For all these latter purposes, gas could be supplied at a considerably cheaper rate than at the present charges, if it were not for the statutory obligation to have sufficient illuminating hydrocarbons present to supply a specific amount of light when tested in the orthodox way. Gas companies are, in fact, somewhat comparable to water companies in this detail. Both are vetoed on the ground of capital expenditure from employing a dual system of mains; and yet both have to supply to the public a material of a higher standard than is necessary for all requirements. Water companies have to produce an article up to a standard for drinking purposes, when a large proportion of the supply is devoted to flushing sewers and domestic drains, watering streets, and extinguishing fires; and gas companies have to comply with a standard of light, when an increasing proportion of their manufacture is being used for the development of heat and motive power. In the interests of the general public, all this is at present necessary; and it is simply mentioned in order to point the more forcibly what economies, in the question of gas supply, might be effected if future discoveries could give the necessary developments.

The discovery of a system of light production from gas as a pure function of heat, and comparatively independent of the presence of luminous hydrocarbons, is now an accomplished fact; and that the system is capable of development has also been recently illustrated. It is not, therefore, unreasonable to anticipate further improvements. The invention of some modified form of burner, which, while maintaining its illuminating efficiency, would stand a fair amount of rough usage with impunity, and which was, moreover, produced at a price well within the purchasing power of the average consumer, would make it possible to have almost a practical revolution in gas lighting. Pure heating gas could then be supplied at a considerably cheaper rate than has now to be charged for luminous gas. Such gas would have a far greater employment for heating and motive power, and light would be developed where required more economically than by the ordinary burners at present in use. The gas manufacture of the future might therefore be, without entering into minute details: (1) The carbonization of the coal to its extreme limits of gas production; (2) the extraction of the benzol as a bye-product, by the passage of the gas through heavy mineral oils, and subsequent distillation; (3) the production of water gas from the coke, to subsequently mix with the gas from the coal; and (4) the utilization of the producer gas, formed during the intervals of "blowing up" the coke to incandescence, to heat retorts and raise steam for general motive power.

The Natural Gas Supply.—All accounts received from Ohio, says an American contemporary, agree that there is a decided shrinkage in the supply of natural gas, and that the time is approaching when the pressure will become so reduced as to make long-distance conveyance a matter of such cost as may render the question of utility an open one. There have been two or three scares in Ohio upon previous occasions. But investigation has, in each case, shown that the gas was still there in large quantities; and it has seemed that proper economy in place of reckless waste would save it for many years to come. Now, however, indications point to such an exhaustion as renders even the most careful economy futile. From nearly all of North-Western Ohio, the story is much the same; and unless new fields are found where they are not now suspected, the end of the prime usefulness of natural gas is drawing to a close in this section. The brunt of this failure, if failure it be, will fall upon the factories, which will be the first to be cut off from lines not under their control; while the advance in price necessary upon increasing cost, will save the private consumers in the more favoured localities from early return to coal or wood. At the same time, each succeeding winter will force the line of consumers farther until the gas shall come to be a summer fuel.

EXPERIMENTING WITH A VIEW TO THE DEVELOPMENT OF GASHOLDER CONSTRUCTION.

THIRD ARTICLE.

By F. Southwell Cripps, Assoc.M.Inst.C.E.

In the first article I drew attention to the defect in the experiments made by Mr. E. L. Pease and myself—viz., that the experiments did not conform with the conditions under which actual gasholders work, and, indeed, differed very widely from them on a most vital point. In the second article, I proved that, if the model had been subject to similar conditions to those to which an actual gasholder would be liable, it would have buckled under a very little side pressure; and hence the opposite conclusions to those deduced by Mr. Pease from the experiments are the correct ones. It was also shown how the results of the experiments as regards horizontal buckling could have been very easily anticipated and determined by calculation, as they only follow very simple mechanical laws relating to cantilevers. After a brief reference to the extent to which the models would deflect out of the perpendicular under side pressure if "hinged" and free to swing over until equilibrium resulted, it was announced that the resistance offered by the side sheeting to this deflection would be dealt with in the present article. To save referring back to the last article, figs. 7 and 8 are reprinted.

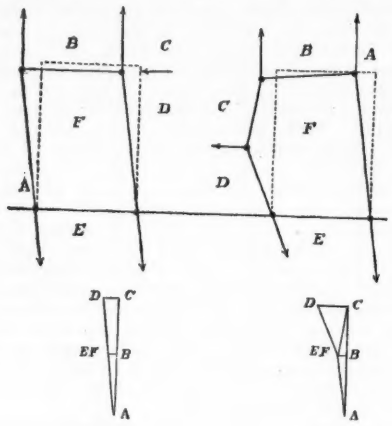


FIG. 7. FIG. 8.

A B, B C } Upward pressure of gas on holder.
C D Effective force of wind.
D E, E A } Tensile resistance at bottom. They likewise show the angles of displacement from the perpendicular of the sides of the holder to produce equilibrium; presuming all parts are hinged, and have no diagonal stiffness.

In the above figures, we observe the effect of a side force on linked frames subject to upward forces in a vertical direction, and the corresponding downward reactions required at the base to produce statical equilibrium.

Now, in the experiments, the vertical reactions were obtained by heavily weighting the bottom curb of the model; and hence the model, if it were simply a "hinged" structure, would have deflected or leaned out of the upright to an extent which is exactly determinable by constructing diagrams like figs. 7 and 8. But in order for a model under vertical tension to bend over in the way indicated in figs. 7 and 8 until equilibrium resulted (see Note B, at end), it would have to overcome all the diagonal resistance of the side sheeting. It is the efforts the sheeting makes to resist this bending which causes the corrugation or fluting of the sides observed by Mr. Pease and myself, and as shown by the exaggerated sketch fig. 9.

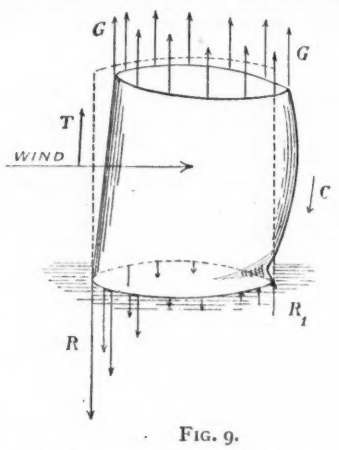


FIG. 9.

G Gas pressure lifting holder.
T, C } Tension and compression induced by wind.
R Reaction = T + G } Due to base being preserved
R1 Reaction = C − G } horizontal.

The diagonal resistance it offered in this way prevented the models pushing over to the *fullest* extent that they would otherwise do if they were merely linked frames with hinged joints, as shown in figs. 7 and 8. But if it were merely a *hinged frame*, it would no longer be a cantilever; and the wind pressure would not then induce any compressive strain on the "off" side. That it does so, however, is obvious, and is proved by the restricted displacement or deflections from the perpendicular, as well as by the *horizontal* crippling at the base on the "off" side, as soon as the pressure found to be necessary by calculation is reached (see Mr. Pease's tables, *ante*, p. 142). If, however, the model has *no vertical tension* at the bottom part, as in fig. 6 (and it should not to accord with real life), it first yields by compression due to transverse strain. As soon as this commences the diagonal resistance offered by the sheeting comes into play; and the fluting or diagonal buckling of the sides becomes apparent, with the result shown in fig. 10.

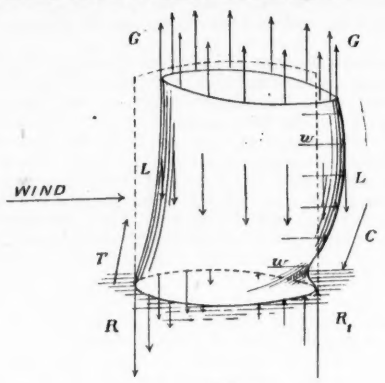


FIG. 10.

G Gas pressure lifting holder.
L Reaction to G (at centre of gravity of holder).
w Effect of wind.
R Reaction = T } Due to base being preserved
R1 Reaction = C } in horizontal plane.

The fluting or corrugating of the sides observed by Mr. Pease was, of course, due to the efforts the brown paper made to resist the pull in a diagonal direction caused by diagonal strains; but to do this the sides have to *flatten themselves against the internal pressure of gas*, and which, of course, in its turn endeavours to preserve the vessel in a cylindrical form.

The extent and value of the diagonal resistance of the skin or side sheeting under gas pressure is a most interesting problem, and was entered into very minutely in my report on the strains in Mr. Livesey's large gasholder at East Greenwich, prepared in December, 1891, for the South Metropolitan Gas Company. In this report the influence of the gas pressure on the side sheeting in assisting the latter to resist diagonal strain was clearly shown and the strains approximately determined (see Note B). When it is remembered that this enormous gasholder (300 feet diameter) has six lifts—two of which are *free*, and tower above the guide-framing—it will be seen at once how essential it was to make sure that the strains due to all possible causes should be fully investigated and met.

It must not be supposed, however, that the diagonal strains on this large gasholder were in any way equal to what they would have been if it had had no vertical stays or guide-framing at all. It has guide-framing to the height of four of its lifts; and therefore it has the enormous advantage (over the non-guide-framing type) of the dead weight of four lifts hanging on the bottom curb, as it were, of the other two. This dead weight provides that initial tension in the side sheeting, &c., which the patented non-guide-framing types so sadly need, but which they lack altogether (see Note C).

It is only then by the resistance offered to diagonal strain by the thin side sheeting, aided by the gas pressure from within, that a gasholder without vertical stays and guide-framing could stand at all as a cantilever against the wind pressure. If it were simply a linked frame, it would deflect out of the upright to such an extent as to be perfectly useless. It is by reason of the sheeting converting it into a cylindrical cantilever (and subjecting the whole structure to the laws relating to cantilevers) that it has any stability at all. We have seen that the effect produced on the sheeting (due to this work required of it) is that shown by fig. 10, above, and which is fully borne out by experiments. It is for gas companies to decide whether they will allow their gasholders to be subject to such treatment; but, as an engineer, I should not think of recommending a gas company to adopt a structure which, for its stability, depends upon the distortion and fluting of the sides, though to so small a degree that it cannot be readily observed—for, if the strains are *there*, the tendency to distort exists from its very construction. It cannot be so durable and lasting as a self-contained and perfectly-protected gasholder surrounded with *properly-designed* guide-framing, where there is not a tithe of the racking, twisting, and joint ripping kind of strains.

I have always contended, and I still hold, that a perfect gas-holder is one in which the strains on the bell or gasholding portion are reduced to a minimum.

The light, flimsy bell which contains the gas does not require extra inducements to leakage. Anything tending to promote leakage in the joints, or reduce its durability, can scarcely be received with favour by gas engineers, however much they may feel disposed to encourage ingenious inventions.

NOTE B.

The following is an extract from my report on Mr. Livesey's holder. The extract refers simply to the strains in the second lift :—

"There are, however, two other points deserving attention, and which conduce to the safety of the holder—(*a*) That due to the influence of the upward vertical pressure of the gas. (*b*) The assistance rendered by the gas pressure in preventing distortion of the side sheets in every bay.

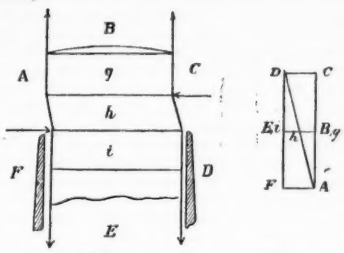


FIG. 11.

FIG. 12.

"(*a*) If the guides were hinged or pivoted at both top and bottom, and the side sheeting was sufficiently elastic to yield to the holder tilting, it can be proved that the holder could not possibly rack forward, as shown in fig. 11, more than a certain distance, and which distance is exactly determinable by constructing the diagram of forces (fig. 12). If D C represent the wind force, A B and B C the effective vertical gas pressure, and D E and E F the hanging load, then will A D be the actual *leaning* out of upright of the second lift ; and the only force acting on the guides would be direct *tension*. In the case under consideration, it would rack out of upright about 1 in 10, or 3 feet. Now, under the assumed conditions, if there were no *vertical* forces (gas and weight) the whole would rack out of the upright until the sides became quite level. We may, therefore, conclude that the upward vertical pressure of gas and the downward hanging weight play an important part in preserving the verticality (if I may so term it) of the upper lifts.

"(*b*) But the pressure of gas on the side sheeting in an outward radial direction exercises a greater influence over the lifts in preventing distortion of the cylinder between the vertical guides or stays by any diagonal force. The assistance rendered in this way may be shown thus : Take one bay as shown by the following sketch (fig. 13). The

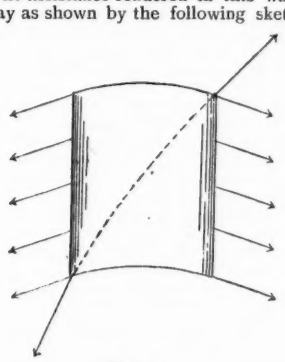


FIG. 13.

gas pressure causes a tension in the side sheets, the direction of which is indicated by the arrows. The direction of the gas pressure causing this tension is, of course, outward or *normal* to the curved surface. It is evident, therefore, in order to *depress* the curved surface, this outward pressure must be overcome. If we imagine forces to be applied in the direction of the dotted arrows at the top and bottom corners—*i.e.*, in a diagonal direction—in order to flatten the curved surface represented by the dotted line, it would be necessary to exert sufficient force in a diagonal direction to overcome the outward forces acting normal to the dotted line."

Then follows the application of this principle to the gasholder ; the strains being calculated in detail.

NOTE C.

Gasholders with partial guide-framing—that is, guide-framing reaching the height of two lifts in a three-lift holder—are subject to different conditions altogether from those entirely without guide-framing, inasmuch as the dead weight of the hanging lifts (supported by guide-framing) materially assists the upper ones (which are free) in resisting the transverse strain due to wind pressure, by reason of the *initial tension* the hanging load imparts to the side sheeting of the free lifts in a *vertical* direction. The experiments made by Mr. Pease and myself do, in a measure, apply to this class of holder, although it is very doubtful that the proportionate deflections from the perpendicular recorded by Mr. Pease in his experiment would be allowable in an actual gasholder. But it is not of gasholders possessing guide-framing, however short, that I have been treating—firstly, because Mr. Pease's experiments did not bear reference to this type ; and, secondly, I have already treated of this class of holder, in as complete a manner as will meet all practical cases, in my book on "The Guide-Framing of Gasholders."

GAS AFFAIRS IN BOSTON (U.S.A.).*

By Our American Correspondent.

From present appearances it looks as if the long-standing controversy between the Boston Gas Company and their customers in relation to the price of gas has been settled, at least for the time being. It may be remembered that, about four years ago, a special rate of $1 per 1000 cubic feet was made with the large consumers ; the price to the general public or the small customers being 30c. higher than the above-named figure. It will also doubtless be recalled that last year this arrangement terminated by limitation. The hotel-keepers and other large customers have since that time been compelled to pay the regular rate ; and as a result, they commenced an agitation for a general reduction in the price of gas. This has been dwelt upon before ; and I touch on it now merely to refresh the reader's memory—noting that attention was then called to the matter being before the Massachusetts State Board of Gas and Electric Light Commissioners. I have now to add that the Board have given their decision in the case ; or perhaps it might more correctly be said that, the contending parties having arrived at an agreement, the matter was practically withdrawn from the Board. This termination of the case was brought about by a proposition made several weeks ago by Mr. Moody Murill, the Counsel for the gas consumers, to the effect that, if the Boston Gas Company would increase the illuminating power of their gas to 25 candles, and grant a rebate of 10c. per 1000 cubic feet (making the net price $1·20) to those using $1000 worth of gas per annum, and if the Company would supply gas of the quality above noted for fuel purposes, through a separate meter, at $1 per 1000 cubic feet, the petitioners would acknowledge themselves satisfied, and drop the case. This proposition was practically agreed to by the contending Counsel several weeks ago ; but it has only just been ratified by the following action of the Company :—

Boston, Dec. 12, 1892.

At a meeting of the Board of Directors of the Boston Gaslight Company held this day, it was noted : (1) That, on and after Jan. 1, 1893, the price of gas used for cooking, heating, and power purposes be fixed at $1 per 1000 cubic feet, measured through an independent meter supplied by the Company free of rent ; (2) that, on and after Jan. 1, 1893, the price of gas to all those who burn for lighting purposes $1000 worth and upwards per annum be fixed at $1·20 per 1000 cubic feet ; (3) that, on and after Jan. 1, 1893, or as soon thereafter as the new water-gas works in process of erection at the North End station are finished, the candle power of the gas supplied by this Company be 25 candles ; and (4) that a certified copy of the preceding notes be filed with the Board of Gas and Electric Light Commissioners.

Reviewing the foregoing, it will be noticed that the general consumer obtains a concession in the form of an increase in candle power, which is theoretically a jump from 16 to 25 candles—the former being the illuminating power the Company have been required by statute to furnish. But, as a matter of fact, the Boston Company have been selling gas of about 19-candle power for some time ; so perhaps the consumer will not get the benefit he anticipates. However, it may also be said that, if a general reduction in price had been ordered, the Company could have reduced the illuminating power to 16 candles, if the management so desired. If we divide the price by the candle power, and so get the cost of 1-candle power, we find $1·30 ÷ 19 = 7c. the cost prior to Jan. 1, 1893 ; $1·30 ÷ 25 = 5·2c. the cost after that date ; $1 ÷ 19 = 5·3c. the cost if the price had been reduced to $1 and the illuminating power had remained unchanged ; and $1 ÷ 16 = 6·2c. the cost if the price had been reduced to $1 and the illuminating power had been reduced to legal requirements only. It will thus be seen the consumer will make a substantial gain—the increase in lighting power being theoretically equal to a reduction in price of about 25 per cent. He is a little better off than he would have been if the price had been brought down to $1 and the candle power left unchanged ; and he has a theoretical gain of 16 per cent. over a reduction to $1 with a drop in light-giving power to that point below which the law would prevent the Company going—viz., 16 candles.

I say "theoretically" the above results would ensue to the Company's customers. But the question arises : Would theory and practice be one in this particular ? I think so, for the reason that the specific gravity of the gas will rise with the increase in illuminating power ; and hence the rate of flow of gas through a burner will be decreased. It may therefore be reasonably expected that a burner giving proper results with 19-candle gas will be proportionately efficient with 25-candle gas passing at a decreased rate. It is also worthy of note, in this particular, that the Boston Gas Company have adopted a very wise and comprehensive system for following up the burner question. Hence we find less trouble from inferior burners in that city than in others of like size ; and we hope to see such a broadening of this plan as will result in the customers of the Company obtaining an economy in candle power commensurate with the theoretical increase in the illuminating efficiency of the gas.

On the matter covered by the vote giving a rebate of 10c. per 1000 cubic feet to customers using $1000 worth of gas per annum, I have little to say—recognizing, on the one hand, those who feel that gas is a necessity, and should be distributed at a

* Previous articles on this subject were given in Vol. LIX., pp. 448, 761, 788.

uniform rate to all; and, on the other, appreciating the justice of the contention that, in trade, the unit of price decreases with the increase in the amount of goods purchased. On this ground a gas company, in fixing a special price for large consumers, only follows the ordinary practice of commerce. I do not think the rebate is excessive; and, when allowance is made for the relative quantity of gas sold per unit of capital investment to the small and the large customer, and for the decrease in cost of collection and distribution in the case of the heavy user, I think it will be found that the amount of profit per 1000 cubic feet, or the quantity sold at $1·20 will approximately equal that sold at the higher rate.

When we come to consider the vote which makes a differential price in favour of the consumer using gas for cooking and fuel purposes, we are plunged into a very nice question of gas ethics. We cannot help feeling the apparent justice of A.'s complaint, when he avers that he uses gas for lighting, and possibly has done so for years, and yet he is discriminated against in favour of B., who employs gas for fuel purposes.

To discuss the question in all its bearings would be beyond the scope of the present article. Two thoughts, however, press themselves upon our attention. How far is the differential price in the line of justice, and how far in the line of expediency? There is a certain amount of justice in the scheme, because the user of fuel gas will draw upon the distributing system through more hours than the consumer of gas for lighting, and will very largely take his supply during the time of day when the mains would have but little to do. Hence the increment of capital that will be required to furnish a fuel-gas customer will be less, in proportion to the quantity used, than in the case of the customer for lighting gas; and therefore the gas used for this special purpose might justly stand charged with a small amount of interest on capital. How much smaller would be a very nice question to decide; but certain figures run through my mind as I write. Having regard for the ratio which the investment for the distributing system bears to the total capital account, and the relative length of time the capital would be productive in the one case and in the other, I think a just difference in this particular instance would be 10 to 12 per cent. on the regular selling price.

When we look at the subject from the standpoint of expediency, we find much to commend the differential price, for the reason that gas for fuel purposes is soon to become a very important part of gas companies' business. But it is a section of the industry which must be nursed and fostered. People do not at first appreciate the convenience of gaseous fuel; and therefore they are not willing to pay a bonus for it. The average servant girl does not know how to handle it economically; and consequently, to begin with, the price must be made attractive. But a gas company would be very loth indeed to reduce their income from gas for lighting by 25 per cent. or more in order to secure this new trade, which at the outset might not be 10 per cent. of the total business. It appears, therefore, as a matter of expediency, that there is much in favour of a special price to the fuel-gas customer, which will, in the end, react to the benefit of the lighting-gas customer, as the additional business will lead to a decreased net cost per 1000 cubic feet, which, in a well-organized company, is a forerunner of a reduction in the selling price.

The reference in the third vote to the increase in illuminating power coming into effect as soon after Jan. 1, 1893, as the water-gas works are ready, is explained when I mention that the Company have been busily engaged for many months in erecting these works at their old station at the North End; and they will necessarily be compelled to await their completion before raising the quality of the gas, as obviously they could not afford to make 25-candle gas by the coal-gas process.

The comments of the press on this outcome of the controversy are in many instances amusing. Thus one prominent paper remarks: "Why it is necessary to give to this gas an illuminant force of 25 candles, we cannot imagine. The heating power of a gas is a quality distinct from its illuminating force; and a gas burning with a blue non-illuminating flame may give vastly more heat, and be better suited for service of this character, than a gas which has, through the quantity of carbon contained in it, a very great illuminating power." One cannot help thinking that a little study of the question would show the writer of the above that carbon is quite an important factor in producing heat as well as light.

Petitions have been received by the Gas Commissioners from gas consumers in the suburbs of Boston, asking for a reduction of price in those districts. These are now under consideration; and it appears more than likely that they will be compromised on the same lines as in the city—*viz.*, a small concession in price, and an increase in candle power.

A New Purifying Material.—It is proposed by some recent French patentees to absorb carbonic acid from gas by means of sodium ferrite, which would likewise absorb sulphuretted hydrogen. Carbonic acid forms with the new material sodium carbonate and ferric oxide, which. when heated to a temperature of about 700° C., re-form the sodium ferrite; thus enabling the same material to be used again and again, and compensating for a tolerably high first cost. The patentees propose using a muffle, or revolving furnace, for burning the spent material.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Experiments on the Strength of Gasholders Constructed of Brown Paper.

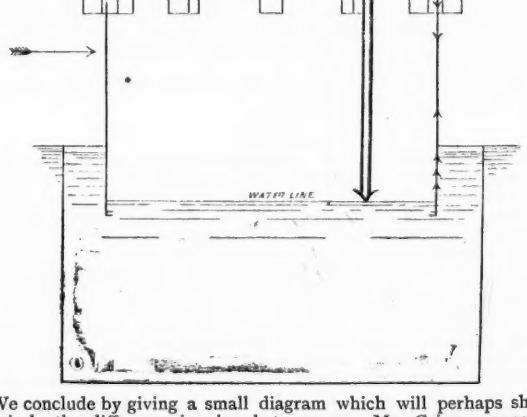
Sir,—No one knew better than those who made the experiments described in my recent communication on the above subject that they were open to the criticism made by Mr. Cripps. The results were offered for what they were worth, on the possibility that they might lead to an expression of opinion. We are therefore gratified that Mr. Cripps has taken the matter up. Although we are disposed to admit that the model does not exactly represent a gasholder under working conditions, we are strongly inclined to think that the brown paper models were more valuable as an object-lesson than Mr. Cripps's criticism allows. They appear pretty conclusively to show that two lifts out of three, or three lifts out of four in large gasholders might, as far as resisting wind pressure when inflated is concerned, be built, as to the sides, entirely of sheets. The remaining lift left in the columns would act in the same way as the weighted bottom curb; producing by its weight a tensile strain in every part of the sides above it, equal to form 2½ to 3 inches of water pressure over the area of the holder. The brown paper model was seen, under similar conditions, to be able to withstand the force of a 45-lb. gale. We are therefore justified in holding that the remark accompanying the description of the experiment has been substantiated, since the conditions in which the sides of the inner lifts are placed when one remains in the columns, are such as to pass the ordeal of your correspondent's criticism.

The remark made was that the experiment pointed to a greater strength in the side sheeting of gasholders than was generally credited. Although this proposition appears to have received confirmation, we are not satisfied that the matter cannot be carried farther, or that Mr. Cripps's explanation goes to the root of the matter.

In venturing rather more deeply into the subject, we feel a great diffidence, as those should who have made "unnecessary experiments." We have the excuse, however, that all problems do not present themselves to us in the simple and inexpensive form of diagrams and equations. The maligned investigations were intended, in the first instance, to only touch on the question of side-sheeting as a factor in the strength of gasholders. They resulted in raising the question whether a holder without vertical stays would be sufficiently strong to resist the force of wind; and they suggested the following argument: Given a holder with a bottom curb level, under all circumstances, it follows that no part of the top curb can approach nearer to the bottom curb than its normal distance—that is, no portion of the side can buckle, without at the same time reducing the distance between the top curb and the water-line. What is to become of the intervening and imprisoned gas? Must it not either escape under the curb, or find place in some other part of the holder by driving out water? and what force has to be exerted to bring about this? The answer is: Sufficient to overcome the water pressure exerted by the holder, which, when 3 inches, is in ordinary holders quite enough to prevent buckling of the sides under ordinary stress. In other words, this power of the gas must be overcome before any downward or buckling force can be transmitted between the top and bottom curbs.

It seems to be beside the mark to lay all the stress on the tensile strain in the sides, and ignore entirely that which creates, and is at least equal to it—the lifting of the gas. At whatever point in the side of the holder the tensional strain is relatively great, whether at the top or not, according as the sides are constructed, its total amount is the same, and finds an equivalent in the supporting power of the gas. In other words, the tension in the sides is secondary, the upward power of gas being primary; and in neither an experimental holder standing on the bottom of a tank nor in a real holder in which the bottom is kept level by other means, can buckling in the sides take place until the upward power of the gas exerted between the surface of the water and the crown, has been overcome.

Mr. Cripps has carefully analyzed the experiments, and shown that the calculations are so easy that the experiments were so much wasted time and money. If Mr. Cripps will transfer the figures he arrives at from the credit of vertical tension in the sides, to the credit of the vertical support of the gas acting between the water surface and the crown, and agree that no shortening of the sides can take place until this has been overcome, we shall be satisfied that there was little wasted after all.



We conclude by giving a small diagram which will perhaps show concisely the difference in view between us. Mr. Cripps proposes that a holder should be weighted at the top, in order to show the great

difference in strength in the sides between this case and when the weight is at the bottom (this is shown in the diagram); the argument being that, in these circumstances, there would be no vertical tension in the sides to counteract the downward force resulting from pressure of the wind on the opposite side of the holder. On the other hand, our reply to Mr. Cripps is that he has put the cart before the horse. That whether or not there is tension in the sides, the supporting power of the gas (represented by the double line in the diagram) exists; and, until it is overcome, it is impossible to transmit a downward force through the sides. The strength of this column varies in direct proportion with the height of the column of water outside the holder; and therefore we submit that, in testing the brown-paper holder, and proving in practice the direct ratio existing between the two, we were not guilty of making absolutely unnecessary experiments. In our view, they point to the fact that a holder increases in strength—that is to say, can stand a greater strain without distortion—in proportion to the water pressure it gives; and this for the simple reason that an increasingly great resistance is offered by the gas enclosed before any downward thrust can come on the sides.

I should add that the suggestion of placing a great weight on the top of extremely weak sides, does not appear to me to be to the point. This is not analogous to the conditions of a gasholder. However lightly constructed, the sides of a holder do not collapse under their own weight. It is presumed that the weight to be placed on the top of the brown-paper model represents the weight of the ironwork in an ordinary holder. This is not so; for in one case the gas is relied upon for support, while in the other the sides are sufficiently strong to stand whether inflated or not. In the one case also, it requires all the support of the gas to keep the vessel intact under favourable circumstances; in the other, the vessel has sufficient strength in itself for favourable circumstances with the support of the gas in reserve to meet emergencies.

The brown-paper model experimented upon could just stand uninflated; but with 3 inches of water pressure, it had great additional strength. To secure the water pressure, weights were added to the bottom curb. My contention is that, if the holder by itself had a weight to give the 3 inches, and was then just able to stand in an *uninflated* condition, it would show the same additional strength when *inflated* as in the former case. A holder floating on the water with a level bottom curb, is provided by some means with support to the curb. The sheets on the curb can, without buckling, stand a compressive force equal to the weight of the holder. When the holder is inflated, there is no compressive force on the sheets. They will, therefore, not buckle till some external force has brought to bear on them a compression greater than they can stand.

Mr. Cripps makes some very strong assertions, especially in the concluding paragraph of his article, from which we entirely differ. They are, however, only offshoots from the main point on which we have endeavoured to express our view.

It was not noticed, until the above had been written, that there was more to follow from Mr. Cripps's pen. Seeing that issues already raised are mainly, if not entirely, dealt with, perhaps you may not consider it premature to insert this letter, in your next issue.

E. Lloyd Pease, Managing-Director,
Messrs. Ashmore, Benson, Pease, and Co., Ltd.,
Stockton-on-Tees, Jan. 20, 1893.

The Recovery of Bye-Products from Coke-Ovens.

Sir,—I see in your issue of the 3rd inst. a notice of a paper by Dr. C. Dreyfus. In this we are again treated to the possibility of "eating our cake and having it;" or, in other words, making a first-class furnace coke, and at the same time saving the tar and ammonia. "Ovens effecting this desirable object are said to have been for 30 years in general use in Germany, Belgium, and France; while in Great Britain nothing seemed to shake the belief of iron smelters in the infallibility of the beehive ovens."

If this is so, can it be said that it is from want of inclination or experiment? Are these iron-smelters so blindly conservative of old practices as to deny themselves all the enormous advantages which have been dangled before their eyes at something like quinquennial periods by the inventors of ovens—sometimes vertical, sometimes horizontal, now round, and then square, but all ending in the same close retort, with the gases drawn off, condensed, and returned to carry on the coking process? I think not. I have been for more than 40 years engaged in making furnace coke; and have seen practically all that has been done, and tried some of the schemes myself. So that when Dr. Dreyfus says he can add his testimony to that of Dr. Lunge, that the coke made in the ovens where the bye-products are recovered is now declared to be equal in quality to the coke made from beehive ovens, I must be allowed to say, We have heard that a good many times before.

I will refer to one or two only of the latest experiences. In 1880, a paper was read before the Iron and Steel Institute by Mr. Simon, of Manchester, upon the Carvès, or Simon-Carvès, ovens. He says: "The coke made in our ovens is, given the same coal, harder and denser than that produced in the beehives." He admits it has not the same silvery appearance. "But this is a matter of appearance only;" and in an advertisement of these ovens it is stated: "Extra profit in coke, tar, and ammonia, about 7s. per ton; sulphate and benzol manufacture at the ovens as now being adopted by us increases the profit to 9s. to 10s. per ton." That was in 1885; while in a later paper, published on behalf of these ovens, their advantages are given as yielding a profit of 107 per cent.

Attracted by these wonderful pictures, and notwithstanding previous ventures by others, in which many thousands of pounds had been sacrificed over ovens of other inventors with similar objects, two large colliery-owners tried their hands, and put up blocks of ovens with sulphate-making apparatus. And yet, after 13 years, in Durham, where we have 19,000 ovens, there are, I believe, only 150 of this class (and some of them, I am told, are out for want of trade); the promises of 7s. to 10s. per ton profit on bye-products have proved insufficient to secure their adoption. Is this not far more reliable evidence than any mere *ipse dixit* of Brown, Jones, or Robinson, who persist in asserting that the retort-made coke is all that furnace managers can desire? The volumes of the Iron and Steel Institute remain as a testimony how, years ago, such material had been carefully, and with every anxiety, tested and found wanting.

Everyone admits that common gas coke will not answer. Its original coal may be just the same, and its treatment in manufacture attains the same end; only its structural features differ from the best coke. We have then the soft coke of the gas-retort; the brilliant, crisp coke of the beehive; and the solid, lumpy material of the patent bye-product ovens. Of the three, the blast-furnace says: "Give me the beehive coke if you want me to do good work;" and the ironmaster says: "I have spent £20,000 on my furnace, and I must and will have the coke which gives me the best result." As Mr. F. P. Dewey says, in a paper read to the American Institute of Engineers, "one of the prime factors, upon which the superiority of coke as a fuel rests is its porosity, which determines its rapid combustion by penetration of the gases into its substance." Dr. Thorner, in an article published in *Stahl und Eisen*, says (after a careful study of the question): "Ordinary gas coke possesses lower real and apparent specific gravity than oven coke, and shows more cell space in its substance."

In addition to the porosity, there must be hardness to resist crushing. That the patent coke possesses this quality, I do not deny; but it is the hardness of the solid stone, into which the blast cannot penetrate. And so we have the porous but soft coke of the gas-retort; the hard coke of the patent oven; and the *hard and porous* coke of the beehive oven, which exactly hits the demands of the blast-furnace. Is it not reasonable to suppose that there is a happy medium in the treatment of the coal, which—avoiding the low heats of the gas-retort on the one side, and the high heats of the patent ovens on the other—exactly produces what the blast-furnace requires?

The latest costly experience has been with the Bauer oven, which was fully described and illustrated in *Engineering* in 1887 and 1890. In the latter year, the writer in that paper says: "We believe we are correct in asserting that for some time these new ovens proved a considerable anxiety both to their inventor and to Messrs. Baird and Co. (the owners). It is, however, gratifying to learn that they are giving satisfaction now, notwithstanding that the circular arrangement does not appear to have fully realized the expectation of its inventor." As they seemed to be a very complicated concern, I went over to Glasgow to see them during construction; and the owners promised to let me know when they were successfully at work. But this information never reached me; and, so far as I have been able to learn, they were a failure.

The writer goes on to say that "the circular arrangement does not appear to have fully realized the expectations of its inventor, and manufacturers have returned to Dr. Von Bauer's rectangular arrangement;" and upon these lines a plant of 40 ovens was erected by the Carlton Iron Company, in Durham. Now, as both these firms made and used their own coke, it seems quite impossible to believe that any mere prejudice in favour of beehive coke could lead them to abandon them and all the capital expended. But when I recently visited the latter works, after being out a long time they were again working, the coke would, if I am any judge, be unsaleable in the open market; and the manager said he would never build any more.

Mr. Henry Simon, in his paper on the "Simon-Carvès" oven, read before the Iron and Steel Institute in 1880, says: "The old-fashioned 'practical man' may look with some prejudice on coke made this way . . . but this is a matter of appearance only." Unfortunately, the practical man had based his views on many years of experience, and he proved to be right; and "the coke which is quite as hard as is desirable" was found too dense.

But to return to Dr. Dreyfus. I have before me a plan and particulars of these Semet-Solvay ovens. So far as I can judge, they are very much the same as the Simon-Carvès; and when they come to be tried with rich hot-burning English coals, will, I fear, give no better results. The Doctor says: "Finally, if all coals used in factories and works and houses for heating purposes and for production of power were coked, the gas and coke would be available for heating and lighting purposes." I can hardly suppose that he is ignorant of the fact that only certain kinds of coal are suited to coke-making. I do not quite see how he would utilize all the coke for heating purposes; and he is perhaps also overlooking the fact that, "in the near future," all our lighting will be done by electricity, if there is any basis for the often-repeated prophecies of our friends the electricians. However, sufficient for the day are the benefitsthere of. Let us see the Semet-Solvay coke freely "operating" the English blast-furnaces, after which "the benefits to our agriculture and industry, and the bright and clear atmosphere of our towns (in which it will be a pleasure to live)" will secure the early attention, amongst others, of

A. L. Steavenson.
Durham, Jan. 16, 1893.

A High-Temperature Furnace.

Sir,—The lime furnace mentioned on p. 93 of your last issue, and ascribed to M. Henri Moissan, is one of the oldest forms of oxy-hydrogen furnace known. I have been familiar with it for at least twenty years; and the fact that it is described and illustrated on p. 402 of the third series of "Lock's Workshop Receipts," published by Spon in 1884, is a sufficient proof that others are at least as familiar with it as myself. It is, I believe, the only form of furnace ever used commercially for the fusion of platinum in bulk. The use of this furnace with the electric arc by M. Moissan may be new; but the furnace itself is certainly both old and in ordinary commercial use at the present time. It is not, and cannot be, "common," for the simple reason that fresh blocks have to be cut as required. They break up, and become useless after once heating, exactly in the same way as the lime cylinders used for the oxy-hydrogen light. Owing to the perishable nature of the material in air, the furnace casings are, of course, never made for ordinary sale, and are never shown; and it is therefore natural that any person, not thoroughly familiar with the use of high-temperature furnaces, might easily make the mistake of supposing it to be new.

With reference to the risk of injury to the eyes and face from exposure to the intense light and heat, there is not the smallest risk

of this if the usual screen of dark green glass is used. It is the common practice to employ brown or black glass for the electric arc; but I greatly prefer very dark green, as it admits of a much better examination of the progress of the work. With this and woollen gauntlets and gloves thoroughly wetted, the fiercest heat can be faced and dealt with, without the slightest difficulty or annoyance.

THOS. FLETCHER.

Warrington, Jan. 19, 1893.

Investments of Reserve Funds.

SIR,—I should be glad if you would kindly allow me to put, through the medium of the JOURNAL, the following questions, the discussion of which cannot fail to be otherwise than of interest to secretaries of gas companies.

A gas company accumulates a reserve fund of £5000; being the maximum amount allowed to them, in accordance with the terms of section 31 of the Gas-Works Clauses Act, 1847. In course of time, this amount becomes more valuable, to the extent (say) of £500, by reason of the market appreciation of the particular stock in which it was invested. Presuming that the Directors wished to realize, would the above profit of £500 have to be placed to the credit of the profit and loss account, or would it still belong to the reserve fund, and the total realization have to be reinvested? Or supposing a loss of (say) £500 is incurred on the investment, and the Directors realize, would they be acting within the terms of the section if they made up this loss out of the profit and loss account? If so, is an application to the Justices necessary? To what extent may the words "Government or other securities," which occur in the above section, be interpreted?

A SECRETARY.

Jan. 21, 1893.

Taunton Electric Lighting.—At the last meeting of the Taunton Town Council, the Electric Light Committee reported that it had been decided that an application should be made to the Local Government Board for leave to borrow £16,000, instead of £14,000 as originally estimated, for carrying out the electric lighting scheme. The report was adopted.

Sales of Shares.—At the Auction Mart, Tokenhouse Yard, E.C., last Wednesday, Messrs. Edwin Fox and Bousfield sold half of a King's share in the New River Company at the rate of £87,310 per share; and part of an Adventurer's share, at the rate of £89,400 per share.———Last Friday nine £5 shares in the Brompton, Chatham, Gillingham, and Rochester Water-Works Company were sold by public auction for £15 2s. each.

Penrith Water Question.—At their meeting last week, the Penrith Local Board spent two hours in considering the water question, which has, for the last twelve months, formed a continuous topic of discussion. Arguments in favour of a retention of the river scheme in some form, or of going to Ullswater, were introduced, and were strengthened by reports and correspondence from Dr. Robertson, Mr. G. F. Deacon, and Dr. Stevenson, of Guy's Hospital. By eight votes to two, it was agreed to improve the supply by extending the existing works.

Private Bills (Session 1893).—Among the memorials complaining of non-compliance with Standing Orders which have been deposited in the Private Bill Office in regard to the remainder of the Bills on the General List of Petitions, are the following: By the Corporation of Plymouth and the Devonport Hill Company, in reference to the East Stonehouse Water Bill; by Mr. John Baird and another, in regard to the Rochester Extension and Water Bill; and by Mr. Albert Sill and another, as to the Staines, Chertsey, &c., Districts Sewage Board.

Damage to a Public Lamp.—At the Pontypridd County Court last Thursday, before Mr. Gwilym Williams, Messrs. Banfield and Co., Limited, aërated water manufacturers of that town, were sued by the Llantrissant Gas Company for having caused damage to a public lamp. It appeared that, while one of the defendants' servants was delivering goods, which he had brought in a cart, the horse bolted, and the result was the injury for which compensation was sought. The Judge decided that the damage was accidental; and he gave judgment for the defendants, without costs.

Gas Explosion at Consett.—Last Wednesday week, a disastrous explosion, caused by an escape of gas, occurred in the shop of Mr. C. Weaver, furniture dealer, of Consett, totally wrecking the premises, and destroying a large quantity of furniture. Two large plate-glass windows were blown out; and some boys were cut by the flying pieces of glass. A man named Elliott, who was entering the shop, sustained a nasty cut on the forehead, and had his leg broken. Injury was done to the adjoining property; and Mr. Weaver's premises were in such a dangerous condition, that a barricade had to be placed around them. The damage is estimated at £800. It is supposed that gas from a leaking pipe had accumulated under the shop; but how it came to be ignited is not known.

The Recent Labour Troubles at the Rotherham Gas-Works.—Mr. G. Swallow, the Rotherham Branch Secretary of the Gas Workers' Union, who was recently charged with inciting the night stokers at the Rotherham Gas-Works to insubordination, has written to a local paper to deny the accusation. He says: "I stood between the men and the Manager of the gas-works, and tried to induce the men to work; and I also told them that whatever they did would be at their own risk and responsibility. I have also strong evidence to prove that I never tried to induce them to cease working. I know the foreman was suspended four hours before I left off working; and if there had been any counselling, it would have taken place before the night men commenced. The men complain that the Manager rules in a very arbitrary manner; and it is impossible for me as Branch Secretary, to keep them in order. I am also quite willing to meet the Manager or the Committee to prove that the charge was unfounded, and also that I am no conspirator, but have used my best endeavours to meet the requirements of the Corporation all the time I have been in their service. I trust that either all or some part of the members of the Corporation will see that the matter is thoroughly investigated, as I consider this charge is a great blemish on my character."

LEGAL INTELLIGENCE.

STRATFORD POLICE COURT.—Saturday, Jan. 14.

(*Before Mr.* A. JOHNSTON, *Chairman, and a Bench of Magistrates.*)

Walthamstow Local Board v. Lea Bridge District Gas Company. Conviction for Supplying Gas of Deficient Illuminating Power.

In this case the Lea Bridge Gas Company were summoned, at the instance of the Walthamstow Local Board, for having on Oct. 29 last supplied, at the district testing-station, gas of an illuminating power of less than 14 candles. There was a second summons to the same effect with respect to Nov. 2; but it was agreed to take them together.

Mr. MACMORRAN appeared for the complainants; Mr. HORACE AVORY (instructed by Messrs. Bedford, Monier-Williams, and Robinson), for the defendants.

Mr. MACMORRAN opened the case by citing the provisions of the Gas-Works Clauses Act, 1871, having reference to the testing of gas for illuminating power, and also section 63 of the Company's Special Act, which provided that the illuminating power of the gas should be 14 candles. He merely added that he should prove the appointment, by the Walthamstow Local Board, of the Gas Examiner (Mr. L. Taylor, F.I.C.), and should put in his reports, which would show that the illuminating power on the days in question was less than 14 candles.

Mr. *G. Houghton*, Clerk to the Local Board, was first called, and produced the minutes of that body for Jan. 1, 1892, in which was recorded the appointment of Mr. Taylor, whose reports relating to the testing of the gas on Oct. 29 and Nov. 2, he also handed in. These, he said, showed that on Oct. 29 the illuminating power was 13·52 candles, and for Nov. 2, 13·65 candles.

Cross-examined: He believed that January, 1892, was Mr. Taylor's first appointment; but he did not know what previous experience that gentleman had had as a gas examiner.

Mr. AVORY here remarked that he understood from his learned friend that he was not going to call Mr. Taylor; and therefore he should have to put some questions to this witness concerning the report.

Cross-examination continued: The reports were in printed form; and the heading to the second column read: "Mean lighting power in candles, corrected." He was not aware that the word "corrected" meant corrected for barometrical pressure and temperature. On the face of the report for Oct. 29 was a note made by Mr. Taylor, as follows: "Two other tests were taken prior to the above; but as the candles burned too long—11 min. and 10 min. 41 secs. respectively—the readings, which (corrected) equalled 13·87 and 14·07, cannot be regarded as giving the true value of the gas. The average of the three tests, however, would be 13·82." He did not know what the words "burning too long" meant. In the report for Nov. 2, it was stated that the average of two tests was 13·65 candles.

Mr. AVORY: So that apparently Mr. Taylor on Oct. 29 gave an average of one test, and on Nov. 2 an average of two tests?

Witness: I cannot say.

Do you see on the report for Nov. 2 a note in Mr. Taylor's handwriting: "Two other tests were taken, when candles burnt 10 min. 32 sec. and 10 min. 46 sec.; the average for these two tests being 13·75, or a mean of the four tests, 13·70"? You do not know why those other two tests were not calculated?—I should think it was exactly the same as in the other case, because the candles burned too long.

Continuing, witness said he did not remember, at a meeting of the Local Board in the autumn—before these proceedings were taken—complaint being made to the effect that it was not much use having a Gas Examiner, as he did not seem to do anything at all. Counsel then handed witness reports which were made by Mr. Taylor and sent to the Gas Company in 1891 and 1892; and he then admitted that he had made a mistake regarding the date of his first appointment. He saw that the tests for 1891 gave a very high illuminating power indeed. There was one 17·29 candles, and another 19 candles; but they varied considerably—going down to 16 candles.

After a little discussion on the subject, it was intimated by the Bench that it would be more satisfactory if Mr. Taylor was called; and this was done.

Mr. *Taylor* said he was originally appointed Gas Examiner to the Walthamstow Local Board on Jan. 5, 1891; and he had had considerable experience in the testing of gas. In his tests he used the Letheby photometer. The figure reported for Oct. 29 was 13·52 candles; and 13·65 candles was the average of two of the tests made on Nov. 2, and the mean of four tests was 13·70 candles.

Cross-examined: For about two years prior to 1891, he carried out some work in connection with testing gas for its illuminating power for Dr. Versman at Penge and Sydenham. He then used a Bunsen photometer, which was known as a Letheby photometer, though it was not the same as the one he now worked with. As a scientific man, he was aware that it was necessary to make proper allowance for barometrical pressure and for temperature; but it was not required by the Act. On the two days in question, he did not make any allowance in these respects. His attention had not been called to the fact that the two clocks he used in making the tests did not agree; on the contrary, he had tested them, and found they did agree. He was aware that the Metropolitan Gas Referees required that the candles should burn at least 15 minutes before a test was made; and this was because experience had shown that 10 minutes was too short a time.

Mr. AVORY: Is the burning of the sperm candle in the manner prescribed by the Act, a reliable test?

Mr. MACMORRAN objected to the question.

Mr. AVORY: I am putting the question to show that the condition of the wick of the candles may make a difference in the results.

Mr. MACMORRAN: I understand the question to be rather, whether or not the conditions prescribed by the Act, as to 10 minutes' burning and so on, showed a reliable test.

Witness: My answer to that is that it is not material, because the Act prescribes 10 minutes' burning.

Mr. AVORY: The Act does not say 10 minutes, but for "at least 10 minutes."

The CHAIRMAN: We consider the question a fair one as to the condition of the wicks.

Cross-examination continued: He agreed that the condition of the wicks would make all the difference in the results. Regarding his report of Nov. 2, he made a test at 7.50 p.m.; and the result was 12·87 candles. At 8.45, he made another; the result being 14·44 candles. A further test at 9.15 gave 13·59 candles. The Act required that each test should consist of ten observations made at intervals of one minute. He was aware that the Gas Referees of the Metropolis required that the average of three testings, each consisting of ten observations, should be taken, in order to arrive at the illuminating power, and that, if the average of three tests should show any deficiency below the standard, then a fourth test should be made. He admitted that the 13·52 candles on Oct. 29 was the result arrived at by one test of ten observations, and the 13·65 candles on Nov. 2 was the average of two such tests. Asked for his authority for making a report on one test only, witness said the Act did not specify any number of tests. He was quite aware that, with regard to testing gas in the Metropolis, it was laid down by the Gas Referees that, "at the time of each testing, the gas examiner shall observe and record the temperature of the gas, as shown by the thermometer attached to the meter, and also the height of the barometer," and that "the volumes of the gas operated upon during the testings may be corrected from these data . . . by means of the table given in Appendix C;" but he did not make such corrections. The forms he used for making his reports were similar to those employed in the Metropolis; and the word "corrected" on those forms meant corrected according to the Gas Referees' Instructions. With regard to the testing of the candles, the Gas Company's Manager had asserted that the balance witness used was "sluggish;" but he could not say that he agreed with him. However, the sluggishness would make no difference as to the accuracy of the tests. Interrogated as to whether, if there was a little light striking on the eye, that would affect the appearance of the disc, he said it would depend upon the intensity of the light on the eye. In the room in which his tests were made, there was a gas-jet, which was used for the purpose of examining the gas for its purity; but he denied that the light would reach the observer's eyes or the disc. Witness's attention was called to the high results he obtained from his tests in 1891, and to their gradual diminution; and he ascribed this to "the gas getting a little lower in quality subsequently." In order to show the capacity of witness as a gas examiner, learned Counsel handed him some pieces of acetate of lead paper in a bottle, and asked him whether they showed signs of having been affected by sulphuretted hydrogen; but he would not commit himself to a definite answer.

Re-examined: Before he was appointed by the Walthamstow Local Board, he was engaged in testing at certain of the London stations for some five or six months. With regard to the question as to the clocks, he invariably used the larger one for the candles, having previously tested the gas by it. While the candles were burning, he ran the meter with the clock. The clocks were supplied by the Company; and he had no control over them. The candles and the balance were also furnished by the Company. During his tests there was no indication of a long wick; and, as a general rule, if there was any defect in the candles, it would undoubtedly be in favour of the Company. The condition of the wicks during the tests were exactly as required—these were slightly bent and the tip glowing. As to the corrections for barometrical pressure and temperature, there was no barometer at the station. He had asked for one; but the Company's Manager told him it was not required by the Act, and therefore he could not have one. It was very likely there would be differences in the results of the tests, if the supply was changed from one gasholder to another.

Mr. AVORY: There is only one holder used during the night.

Re-examination continued: The gas-jet which had been referred to (and which was a very small one) could not possibly affect the testing. The apparatus now in use was not the same as in 1891.

Mr. *Otto Hehner*, Public Analyst to the London County Council, testified that he visited the Lea Bridge Gas-Works on Jan. 11, and witnessed some tests made by Mr. Taylor, which were carried out properly and fairly. He checked the readings; and examined the apparatus, which was well constructed, but capable of being slightly improved. Correcting for barometrical pressure and temperature would affect the numerical result of the readings. Then with regard to the candles, every gas examiner of experience had found fault with them as being a bad standard; but, of course, they had nothing to do with that. They were apt to burn very unsatisfactorily; and if they did so, they invariably indicated in favour of the Company. The candle-balance he saw was a remarkably good one.

Mr. AVORY: Since the tests in question, the balance has been replaced by a new one.

By the BENCH: In the Metropolis, the standard illuminating power was 16 candles.

Cross-examined: He could not say from his own knowledge that there was a provision relating to the gas supply of the Metropolis, to the effect that no proceedings were to be taken against a gas company unless there was a deficiency of more than ½-candle in the illuminating power. Regarding the candles, it would make a considerable difference to the results how they were burning; and as to the correction for barometrical pressure and temperature, it was absolutely unnecessary for an accurate test. But to make a strictly comparative test it was necessary.

Mr. AVORY: Am I to understand that, in order to get a result as accurate as possible, the calculations ought to be corrected for atmospheric pressure.

Witness: No; I think it is a most unjust thing. The consumer buys the gas under the pressure that may exist at the time. The testing is for the protection of the gas consumer; and it is unreasonable to force an article with a correction upon him, if he has no allowance made for that correction.

Mr. AVORY was pursuing the point, when

The CHAIRMAN remarked that witness contended the barometer was not required; and, if it were, the Gas Company did not provide one.

Mr. AVORY: That is not the question. What you have to decide is whether this test can be relied upon.

The CHAIRMAN: We are bound by the Act of Parliament upon that point.

By the BENCH: The illuminating value of a given quantity of gas would vary with the barometrical pressure. If the barometer fell, the illuminating power would go down. The variations would not be very large; and the Gas Company, in his opinion, ought to allow for them.

Cross-examination continued: If they had a small gas-jet on one side of the room and none on the other, it would make a difference. When he examined the apparatus, he did not make a correct test of the clocks; but he noticed they were running continuously.

Re-examined: He did not think the little gas-jet made any substantial or practical difference.

By the BENCH: The gas-jet gave a light of about ½-candle power.

This concluded the case for the complainants.

Mr. AVORY said he believed he had sufficiently indicated, by his cross-examination, what the answer of the Company to this case was; but there was one general remark upon the question which they had to decide that day which he wished to make. Observations had fallen from the Bench which would draw from him the suggestion that there was an idea that, assuming the test to have been made by the Examiner in accordance with the Act of Parliament, then the Court would be bound by the report as to the illuminating power of the gas on that particular day; and he joined issue at once on that provision. This was a penal Act of Parliament, which was sought to be enforced against the Company. The section under which the Bench were invited to impose a penalty upon them provided, not that they were to be liable to a penalty if the Gas Examiner's report on any one day should show an illuminating power of less than 14 candles, but that they were to be liable to a penalty if, on any one day, the illuminating power was in fact less than 14 candles; and the question which the Bench had to decide was whether in fact, upon the days in question, the illuminating power of the gas was below 14 candles. It was perfectly immaterial, from any point of view, whether the Gas Examiner had conducted his test in accordance with the particular Act of 1871. Supposing he had conducted it in this way, if he (the learned Counsel) could show that, in point of fact, his report was wrong, and that the illuminating power of the gas was in fact either 14 candles or above, then the Gas Company were not liable to any penalty. It was for this reason that he had introduced the questions as to the regulations prescribed by the Gas Referees, for the purpose of showing the Court, and for forming the foundation of his defence, that Mr. Taylor's report was in fact wrong, whether or not it was made in accordance with the Act of 1871. He was going to produce evidence that it was in fact wrong, and that the gas on those particular days was above the required standard. He should like to deal at once with a point which had been introduced by Mr. Hehner, and which seemed to him to be a proposition on his part to amend the Act of Parliament. It was nothing more nor less than this, because he said that his view was that the consumer was entitled to have the gas, when it arrived at his house, at an illuminating power of 14 candles. Mr. Hehner contended that it did not therefore matter as to the correction for barometrical pressure or temperature, or anything else. That was not, however, what the Act said. In section 12, it said: "The quality of the gas supplied by the undertakers shall, with respect to its illuminating power, be such as to produce, at the testing-place provided in conformity with the Act, a light equal in intensity to that produced by the prescribed number of sperm candles." Therefore, all the Company were obliged to do was to provide that the gas at the testing-place should be equal in intensity to 14 candles, because their Special Act said the prescribed number of candles should be 14. Therefore, he put it that the position was absolutely plain that the Company had fulfilled every requirement of the Act if the gas which they supplied produced, at the testing-place, a light equal to 14 candles; and the question the Court had to decide was whether, on Oct. 29 and Nov. 2, the gas was of this illuminating power at the testing-place.

Mr. MACMORRAN said he might at once accept that.

Mr. AVORY said that being so, the question of fact the Bench had to decide was, whether upon those days the gas was of an illuminating power equal to 14 candles. It being a question of fact, of course everything was material which might tend to show that Mr. Taylor was mistaken in his result. If any one of his witnesses could suggest, quite apart from the Gas Referees' regulations, something which was omitted in the testing, which ought to have been done, and which would have made the result more accurate, he was entitled to do it. The Court had to decide that fact; not whether Mr. Taylor's report showed an illuminating power of less than 14 candles. He did not want to occupy time in traversing evidence which was going to be given by witnesses. It was sufficient for him to say that, for a long time, the Company had been altogether dissatisfied with the tests made by Mr. Taylor; and when he said "dissatisfied" he meant not only with these particular low readings of his, but because, when he was quite new at the work, he made the results ridiculous—showing that his calculations were not accurate, and could not have been accurate. It would be found that in February, 1891, when he apparently commenced this work, he produced a result of over 19 candles, which they would be told was absolutely impossible. The gas they were producing at that time could not possibly have been of such an illuminating power as that; and he supposed one's knowledge of the world generally would be sufficient to satisfy the Bench that a gas company who were only compelled to make gas of 14-candle power, were not likely to be producing it of 19-candle power. Then their dissatisfaction with Mr. Taylor's tests culminated in a letter which was written on Nov. 9 last, by their Solicitors to the Local Board, complaining and su gesting that a new Examiner should be appointed, because they found habitually that his tests were entirely different from those which they were making themselves. He should give evidence to show that tests carried out by Mr. W. C. Young agreed with those made by the Company's own Manager, and differed from those made by Mr. Taylor. Mr. Young had taken the trouble to ascertain the state of the barometer and the thermometer at the time the tests in question were made; and correcting Mr. Taylor's own figures in the proper way, it turned out that the illuminating power was above 14 candles. There was another important thing. As a matter of law, he submitted that the test made by Mr. Taylor on October 29, could not be acted upon. It was perfectly

clear, looking to the schedule of the Act of 1871, that the Legislature intended that every testing to be used against the Company meant a test of more than one set of ten observations. The words of the Act were: "The average of *each* set of ten observations is to be taken as representing the illuminating power of that testing." What was the use of putting in the word "each," unless there was to be more than one. Then, in the first paragraph of the schedule, it said: "The gas in the photometer is to be lighted at least 15 minutes before the testings begin," which implied that there was to be more than one testing. This was the first time the Company had been summoned for deficiency of illuminating power; and it was important to notice that, taking the whole of Mr. Taylor's figures during 1892, the average was 14·91 candles, or 6·5 per cent. above the prescribed standard.

Mr. *W. Thorman*, the Company's Manager, was then examined. He said there were only 39 miles of gas-mains in the district. The gas which was supplied to the photometer-room was taken from the main leaving the works, so that the gas was the same as delivered to the consumers. They had only one holder large enough to supply the gas required during the evening; and they always had that in use. Therefore the tests made must be of gas from one holder. He had frequently made tests immediately before and after Mr. Taylor; and he had often called that gentleman's attention to marked differences between their results. He suggested to Mr. Taylor, among various other little things, that he did not stop the clock quickly enough. As to the point respecting the gas-jet, Mr. Taylor invariably made his tests with it burning; and, in his (witness's) opinion, it was large enough to throw light on the candle side of the disc, which made it worse for the gas. The light given by the jet would be about 1½ candles. From the position of the light, it would also shine in the operator's right eye. On Oct. 29 last, witness and his assistant tested the gas at 5 p.m.; and the result was 15·02 candles. That was uncorrected. At 5.45, they obtained a result of 15·07 candles; and directly Mr. Taylor had gone (9·55), the result was 15·01 candles. A further test was made at 11.15; the result being 14·94 candles. He was in the room while Mr. Taylor was making his observations that night; and he pointed out to him at the time that his readings were too low. On Nov. 2, witness tested the gas at 5.45 p.m., the result being 15·15 candles. At 11.15 (after Mr. Taylor had left) he obtained a result of 15·12 candles. These were not corrected, as it would not be fair then to compare them with Mr. Taylor's tests. With the exception of making the corrections, he always carefully followed the "Instructions" of the Metropolitan Gas Referees. He had been at the work for 25 years; and his experience was that the candles required very careful attention. If a candle-wick was bending over too much, it was going dead against the Company. It gave a large flaring light, and spoilt the whole experiment; and such a candle ought to be rejected. There was another point. At the end of the fifth reading, the operator ought to take the disc out, and reverse it. This was prescribed by the Gas Referees; and, as a matter of fact, it was found that one side of the disc got dry. Mr. Taylor did not do this very often. As to the candle-balance, he had called the Gas Examiner's attention to the fact that it was sluggish; and this would, and did, affect the results. If the balance did not rise at the instant it ought, then the clock would go on for three or four seconds more, and this would, of course, be all against the gas. With respect to Mr. Taylor's return of 19·02 candles on Feb. 21, 1891, he declared they had no coal on the works that would have produced gas of such a high quality. They used the best Durham coal mixed with Silkstone. If there had been any error in the mixing of the coal, he would himself have found it out when testing the gas. The Act of Parliament provided for 14-candle gas and a 16-inch chimney. Even if they had put 2 inches on the chimney, 19-candle gas would have gone over it, so that they would not have been able to test it. To his knowledge, he had never reached above 16 candles.

Cross-examined: The disc and mirrors could easily be reversed in the present photometer. He could not say the disc was not turned by Mr. Taylor when making his tests on Oct. 29; nor did he know that in January, 1891, Mr. Taylor's tests varied from 14·2 to 15·56 candles, but it was quite possible they might have done so. When Mr. Taylor obtained the 19·85-candle result, he did put on a larger chimney; but the flame tailed over it. He maintained that it was impossible to have such a result. He did not suggest to Mr. Taylor that anything he had done on Oct. 29 was improper; but he did complain that he was taking his readings too low. He did not think he suggested to him that he ought to have reversed the disc. On that occasion the gas-jet was burning; and the top of the flame was almost level with the disc. It was burning as full as it could. He first noticed the discrepancy between the clocks when the new apparatus was fixed, some six months since. It was about three months ago that he informed Mr. Taylor of the defect in the candle-balance. The balance had been sent to the Board of Trade; and they had another one now in use. The whole of the apparatus was provided by the Company; but it was stamped by the Board of Trade. Reverting to the clocks, he said there was a variation of about 4 or 5 seconds in 10 minutes; and this would make a difference against the gas.

Re-examined: Witness said he was aware that he was not entitled to interfere during the time the Gas Examiner was making his tests. He had called Mr. Taylor's attention to the fact that it was necessary to shade the right eye, in order to take accurate readings; but that gentleman had not always done so since. If the operator only used one of the clocks, it would not matter whether he used the slow one or the faster. It was by Mr. Taylor's own request that he left the clock in the room which was used with the old photometer.

Mr. *J. Bird*, an assistant at the gas-works, gave evidence to the effect that he checked the tests made by Mr. Thorman on Oct. 29 and Nov. 2, and found them correct.

In cross-examination, witness said he had obtained his knowledge of gas-testing under Mr. Thorman's instruction. On the days in question, he took alternate readings with Mr. Thorman, and also checked that gentleman's observations.

Mr. *W. C. Young*, F.I.C., F.C.S., said he was a Gas Examiner to the Corporation of London and to various other local authorities. He had had 25 years' daily experience in testing gas under all sorts of conditions. For nine or ten years, he was Gas Examiner to the Leyton Local Board; and, in that position, he was in the habit of testing the Lea Bridge Company's gas. In testing gas, a little want of experience, or a little carelessness, would lead to very serious discrepancies. On Nov. 1 last, at the request of the Company, he inspected the apparatus in use at their works. This was about a month before the summons was taken out. His inspection showed there were certain causes which might have led to inaccurate observations. These were: The want of a curtain screen along the front of the photometer; bad ventilation of the room, causing a down-draught; a defect in the candle-balance; and an inaccuracy in the two clocks. The discrepancy in the clocks varied with the degree to which one of them was wound up. When it had nearly run down, it would vary considerably. It would make a difference of 12 seconds in the 10 minutes. He made independent tests of all the apparatus. The reflection from the gas-burner on the right-hand side would reach the operator's eye, if he was not careful; and this was why he suggested the fixing of a curtain screen along the front of the photometer. In his opinion, it was a very serious error to leave the jet burning while making observations. In order to obtain accurate results, it was necessary that corrections should be made for barometrical pressure and temperature. He was not present when the tests were made on Oct. 29; but he had ascertained what the barometrical pressure was on that day, and Mr. Thorman had given him the temperature. Even assuming that Mr. Taylor's return of 13·52 candles was accurate, after being properly corrected it would be 14·12 candles; and, with the two rejected tests, the average, when corrected, would be 14·44 candles.

By the BENCH: The barometrical pressure on Oct. 29 was 29·5 inches; and the temperature, 70°.

Examination continued: Mr. Taylor's figure of 13·65 candles for Nov. 2, when properly corrected, came to 14·04 candles; and, taking into account two rejected tests, the result would be 14·09 candles. He had carefully checked readings made by Mr. Thorman; and they were always precisely the same as his own. On Nov. 24, Mr. Taylor's return was 14·51 candles; and shortly afterwards, witness obtained a result (uncorrected) of 15·27 candles—a difference of more than ½ candle. Returning to the report of Oct. 29, he said it was most unfair to take calculations which were the result of only one testing; and the average of three at least ought to be taken.

Cross-examined: Very different results could be obtained from the same candles, if they were used carelessly. In a paper which he had written on the subject, he had shown that, if candles were used carefully, uniform results could be obtained.* His barometrical reading was made on Oct. 29, about 8 p.m., at his house at Forest Gate. He kept a record of barometrical readings in the City; and on the day in question there was no difference between the City readings and that he made at Forest Gate. Mr. Thorman's note as to the temperature of the gas on that day was 68°. As to the clocks, the Gas Referees required the Examiner to test them. When he first tested the clocks at the Lea Bridge Gas-Works, there was a difference of 5 seconds in 10 minutes; and the last time, when the clock was running down, it was 12 seconds in 10 minutes. If the clocks were used for the candles, it would make a difference of nearly ¼ grain of sperm; and this, with 14-candle gas, would make a variation of 0·18 or 0·17 candle in the result.

Re-examined: He found no defect in the apparatus which told in favour of the Company.

Mr. *William Sugg* was next examined. He said he made the candle-balance which was formerly used at the Lea Bridge works. He had recently examined it, and found it defective; and the officer of the Standards Department of the Board of Trade agreed with him. Such a balance would sometimes tell against the gas, and sometimes for it. He agreed with Mr. Young that no test for illuminating power could be fair, unless it was corrected according to the barometrical pressure and the state of the temperature, and also that it was necessary to take more than one test, in order to obtain a fair result. The object of taking several tests was to neutralize the known errors that there were in the candles, even when they burnt the standard quantity of sperm. There should at least be three tests.

Cross-examined: Five cubic feet of gas could be measured under any state of the atmosphere; and they could regulate the consumption to 5 cubic feet in any state of the atmosphere, but it might be an incorrect quantity. The Act of Parliament did not contemplate an error. He could speak from a long experience in the matter, and from having been present on many occasions when these rules and regulations had been laid down, and it had always been assumed. That was why he thought it was not definitely stated that the correction for temperature and pressure should be always carried out. The candle-balance which had been referred to was correct when it left the Standards Department some six months ago; and he could not say how long it had been wrong. It had been injured—the knife-edge had been turned.

By the BENCH: He thought the word "adjust" in the schedule of the Act referred to a careful adjustment of the whole circumstance.

Mr. *Taylor* (recalled) said, when using the candle-balance, he had never noticed any trace of injury; and the knife-edge was not turned in the slightest.

This concluded the case for the Company.

Their Worships having considered the evidence in private,

The CHAIRMAN said they had come to the conclusion, though with considerable doubt, that the Act required that more than one set of observations should be made; and therefore they dismissed the summons as regarded Oct. 29. Then as to Nov. 2, they had decided on a conviction, holding that they could not import any other apparatus or process into the matter than was required by the Act. This was also a matter of considerable doubt; but, at the same time, that was what they held. In respect of Nov. 2, a fine of ten guineas would be imposed, and the same amount would be allowed as costs.

Mr. AVORY suggested that the Company ought to have costs in connection with the first summons.

The CHAIRMAN said the Bench had not specifically considered the point; but they had made up their minds that, in case both summonses had been dismissed, they would not allow the Company any costs, because they were greatly to blame in the matter of defective

* See JOURNAL, Vol. LVII., p. 249.

apparatus. They had sought to take advantage of their own wrong in this matter; and the Bench would not in any event have given them costs. They would be perfectly willing to state a case.

Mr. AVORY remarked that, having regard to the importance of the question, his clients would appeal in one form or another.

[Messrs. Bedford, Monier-Williams, and Robinson have informed us that their clients have determined, after all, not to appeal.]

WOOLWICH POLICE COURT.—Wednesday, Jan. 18.

(*Before Mr.* KENNEDY.)

London County Council v. South Metropolitan Gas Company—Conviction for Excess of Sulphur in Gas.

To-day the South Metropolitan Gas Company were summoned by the London County Council for supplying, at the Burrage Road (Plumstead) testing-station, gas containing a greater quantity of sulphur than is permitted by statute. The dates specified were July 27 to 30 and Aug. 2 and 3 last; and the average quantity of sulphur found was stated to be 24·82 grains per 100 cubic feet—the limit allowed being 17 grains.

Mr. J. W. GODFREY appeared for the London County Council; Mr. WASHINGTON represented the Company.

Mr. GODFREY said the penalty for supplying impure gas was £50 per day. He did not know that anything could be said in defence, though possibly something might be urged in mitigation.

Mr. WASHINGTON argued that the Council were compelled to take the average purity on three consecutive days; and that therefore the Company ought not to be summoned for three offences committed in three days together. Instead of six summonses and six penalties, there could be only two. The Company had never been summoned before on such a complaint. He could not deny that an offence had been committed; but the Company felt aggrieved by these proceedings, having been the pioneers of gas reform in the Metropolis. The condition that they had infringed was one which forbade more than 17 grains of sulphur in 100 cubic feet of gas; and the infringement was due entirely to the Durham coal strike of last year. The manufacturing plant and appliances were specially adapted for Durham coal; and when the Company were unable to obtain the usual supply, they were compelled to lay in their summer store of other and inferior coal—doing the best they could in the emergency in the service of their customers, who numbered 78,000. This coal, besides being unsuitable for gas making, contained more impurity; and hence the Company's position. They had spent in one week £1500 in attempting to meet the difficulty. Now, however, they had got back to Durham coal, and there would be no more complaint. The average impurity alleged was only 7 grains over the stipulated quantity, amounting to about a grain of sulphur in 3000 grains of gas—no greater excess of sulphur than would be given off by the striking of a lucifer match.

Mr. KENNEDY remarked that the Council could not be blamed for protecting the public.

Mr. WASHINGTON said the public had not suffered; and he asked that only a nominal penalty should be imposed.

Mr. *Frank Livesey*, the Company's Chief Engineer, was called, and bore out Mr. Washington's statement as to the expenditure incurred by the Company in their efforts to keep up the purity of the gas during the time they were compelled to use inferior coal. He added that not one of their 78,000 customers had complained of the quality.

Mr. *Vernon Harcourt*, F.R.S., said he had been asked by the Company to advise them, if possible, in their difficulty. He made several recommendations; but they were of no use. Under the circumstances, the officers of the Company did all they could to maintain the gas at the standard purity; and it was no fault of theirs that this could not be adhered to.

Mr. KENNEDY said that, in supplying cheap gas, the Company had been doing a public service; but it was also a public duty on the part of the County Council to insist on the provisions of the Acts under which the Company were constituted being strictly carried out. Excuses could not therefore be accepted; and he must impose a fine of £5 for each of the six dates on which the test had shown that the gas was not of the required purity.

[In our editorial columns to-day, allusion is made to the above case, as well as to that tried the following day at the Southwark Police Court, as reported below.—ED. J. G. L.]

SOUTHWARK POLICE COURT.—Thursday, Jan. 19.

(*Before Mr.* E. N. F. FENWICK.)

Conviction for Supplying Gas Below the Standard Purity.

To-day his Worship had before him 38 summonses taken out by the London County Council against the South Metropolitan Gas Company for having supplied gas, during August and September last, of a lower standard of purity than that fixed by Act of Parliament.

Mr. J. W. GODFREY appeared for the London County Council; Mr. WASHINGTON for the Company.

Mr. WASHINGTON said he was instructed to plead guilty; but there were circumstances connected with the case which he thought would weigh with his Worship in fixing the penalty.

Mr. GODFREY handed to the Magistrate the report of the Chief Gas Examiner, setting forth the number of times in which, on inspection, the gas supplied by the Company was found to contain a larger quantity of sulphur than the maximum fixed by statute.

Mr. WASHINGTON said the Company did not dispute the facts in the Chief Gas Examiner's report; but they submitted that the circumstances were exceptional, and that a nominal penalty would be quite sufficient to meet the justice of the case. In consequence of the strike of the Durham miners in the early part of last year, the Company were unable to obtain a sufficient supply of coal of the quality from which their gas was manufactured. Anticipating the stoppage of their usual supplies, they obtained coals wherever they could; and, among other places, from Germany. It was found, however, that the coal bought was not suited for their purpose, and that the gas manufactured from it contained a larger amount of sulphur than they could get rid of by the ordinary methods of purification. But the result of the testing showed not more than an average excess of 6·2 grains above the statutable limit, which amounted, in fact, to 1 grain of sulphur in 3000 grains of gas, the effect of which would not be more detrimental than the striking of a lucifer match to light the gas in a room of ordinary size. The Company had endeavoured in every possible way to meet the difficulty which the use of this coal had created, and had spent as much as £1500 extra in methods of purification.

Mr. *Frank Livesey*, the Chief Engineer of the Company, was then called. He stated that, although the Act dealing with the question of sulphur in gas was passed as far back as 1869, the Company had always been able to purify the gas in a satisfactory manner; and this was the first occasion on which they had been summoned. There was no doubt the excesses of sulphur in August and September last were due to the Company being compelled to use other than Durham coal. They obtained coals from Derbyshire; and some of the best and some of the inferior from Yorkshire, Lancashire, Scotland, and South Wales. They found, however, that a different system of purification was required than that to which they had been accustomed. In explanation of the reason why the impurities occurred after the Durham strike had ended, he said that the Company knew there would be a stoppage; and consequently they laid in a stock of coals, which were used during the strike. But towards the end of the strike, they had to purchase some "foreign" coals; and after the strike had finished, they were using these almost entirely—the Durham coal being exhausted. They experienced difficulties at all their works. Some of the Engineers alleged that there was a deficiency of sulphuretted hydrogen, and others thought there was excessive carbonic acid. Since, however, they had returned to the old Durham coal, the purification had not caused the slightest anxiety, although they had made considerably more gas this winter than previously. He added that of the Company's 78,000 consumers, not one had made complaint as to the impurity of the gas.

Mr. FENWICK held that he was bound by the report of the Chief Gas Examiner, who had decided against the Company, and imposed a fine of £4 and costs on each summons; the total penalties amounting to £155 16s.

Utilizing the Power of the Severn for Electric Lighting and Pumping Purposes.—The Bewdley Town Council have appointed a Committee to make inquiries as to the desirability of utilizing the power of the River Severn for electric lighting, and for pumping water for domestic and street watering purposes. Some of the members are averse to the proposal; believing it will entail vast expenditure.

Increase in the Price of Gas used for Public Lighting at Loughborough.—Owing to the serious decrease in the value of residuals as well as the continued high price of coal, the Directors of the Loughborough Gas Company have been compelled to raise the price of the gas consumed in the public lamps from 2s. 3d. to 2s. 5d. per 1000 cubic feet. Even at the higher rate, the charge is a very moderate one.

Electric Lighting for Hull.—The electric lighting installation which has been provided by the Corporation for lighting the portion of Hull contiguous to the docks has been completed, and was formally inaugurated yesterday week by the Mayor (Alderman Dr. Hall). The station contains two 200 and two 80 horse power engines, each attached to a dynamo, from which a pressure of 110 volts will be obtained, though, when necessary, 115 to 120 volts can be reached. The outlay on the works has amounted to £23,072; and the plant is capable of supplying about 5000 16-candle power lamps. In connection with the inauguration of the installation, an exhibition was held in the Town Hall, to demonstrate the many uses to which electricity may be applied.

Gas Affairs at Heywood.—The Gas Committee reported at the last meeting of the Heywood Town Council that, having considered the condition of the borrowing powers and the demands likely to be made upon the department during the coming ten years, they had resolved that steps should be taken to obtain additional borrowing powers to the extent of £25,000 for gas-works purposes. Alderman Firth, in proposing the confirmation of the report, stated that, from March 25 last year, the gas consumed had been 67,083,000 cubic feet, as compared with 63,591,000 cubic feet in the previous twelve months; being an increase of 3,492,000 feet. Since the stoppage of the mills, they had suffered somewhat, having only sent out 23,167,000 feet, against 24,170,000 feet in the same period last year; or a decrease of 1,003,000 feet. The net increase on the twelve months was 2,469,000 feet. As to the proposed powers to borrow £25,000, this seemed a large sum; but if the town should continue to extend as it had lately, and they required money, it would be awkward if they had not some in hand. The Council were obtaining powers to borrow other moneys; and this application was simply included to save expense. The report was approved.

The Tewkesbury Corporation and the Water Supply.—A letter was read at a recent meeting of the Cheltenham Corporation, giving notice that, six months from its date, Tewkesbury would require that the supply of water from the Severn, through the Cheltenham works at the Mythe, should be made in bulk to the Corporation, instead of to individual consumers in the town. The right to demand this is given to Tewkesbury by section 85 of the Cheltenham Water Act of 1878; it being therein stipulated that the right shall be exercised, if at all, within fifteen years of the passing of the Act. The Act received the Royal Assent on July 27, 1878, so that the time limit would have expired on the 27th inst. The notice now given follows upon an overture made by the Tewkesbury Corporation nine months ago to purchase the water-works at the Mythe by agreement. The proposal was of necessity declined by Cheltenham, inasmuch as parting with the works for the supply of Tewkesbury might seriously prejudice the power which Cheltenham holds, and the future value of which it would be difficult to estimate, to abstract water from the Severn. The volume of water which the Act of 1878 gives Cheltenham the right to take amounts to no less than 3,250,000 gallons daily; and this right it is considered Cheltenham will be foolish to jeopardize.

MISCELLANEOUS NEWS.

THE GAS QUESTION IN PARIS.

Proposed Acquisition of the Gas Undertaking by the Municipality.

In the JOURNAL for the 3rd inst., we briefly traced the progress of the gas question in Paris through the mazes of the numerous discussions in the Municipal Council, and brought it down to the point at which the rupture of the negotiations with the Company took place. Things seemed to have come to a deadlock; and so we felt justified in regarding the question as temporarily "shelved." This, however, is by no means its condition. According to a report of the proceedings at the meeting of the Council on the 26th ult. which appears in the current number of *Le Gaz*, it is still very much on the carpet; its latest development being nothing less than a proposition that the Gas Company's undertaking should be at once acquired and carried on by the City. On the above-named date, M. Sauton, speaking in the name of the Streets Committee, stated that the provisional agreement which had been entered into with the Company, and presented to the Council by the Committee, having for its object the reduction of the price of gas, would have to be withdrawn from the *agenda*, owing to the claim unexpectedly put forward by the Company in the course of the discussion. This claim (the purport of which was that they should continue, after the expiration of the concession, in possession of the works, and only hand over the distributing plant to the city on condition that they would be indemnified for it) could, he said, have no other effect than to maintain for thirteen years longer a state of things which would be prejudicial to Parisian interests. Every monopoly, continued M. Sauton, should be carried on for the general good. The moment it was shown that this was not the case, and that the adoption of another system of working the monopoly would enable a remedy to be applied to an improper condition of things—and this had been demonstrated by the reasons furnished to the Council in support of the last convention submitted to them for approval—doubt was no longer possible. The control of the monopoly must, of necessity, be taken out of the hands of the concessionaires. (This remark was followed by cries of "Hear, hear.") It was not denied that a legitimate indemnity was due to the concessionaire for the profit he would have derived from his enjoyment of the monopoly until the expiration of the Treaty concluded with him; at the same time, the right of the city to take over the monopoly, with the object of establishing a system of carrying it on which would give satisfaction to the general interests concerned, could not possibly be contested. The Paris Gas Company could claim the profit they might have realized if they had continued working till Dec. 31, 1905; and, further, they had a right to the share of the undertaking which would at that date come to them on the division of the assets. This, however, was all they could demand. With regard to the first, the Company had made known, during the negotiations, the greatest annual production of gas they could hope to reach; and, consequently, the amount of maximum profits they would be able to realize could be readily arrived at. As far as the division of the assets was concerned, it would be necessary to ascertain exactly the value of the opinions entertained on this subject by the legal advisers of the Company, which were in distinct opposition to the original declarations of their representatives who conducted the negotiations. To wait until Dec. 31, 1905, before attempting to settle the question, would be to display an unpardonable want of foresight. The Company's arrangements were known officially; and therefore the City should take the matter in hand immediately. Numbers of foreign towns had found themselves in a worse position than that in which Paris was now placed. He would cite as an example Birmingham, which, in 1875, took over a monopoly which had been granted to a Company for an unlimited period. The towns to which he had referred had been able to obtain possession of authorized gas undertakings; and there was no reason why it should be otherwise in Paris. The supply of gas could be carried on either by the Municipality itself, or by someone duly authorized by them; but this would be a question for future settlement. The main point now was that the gas monopoly should be taken over by the City, and carried on in the general interest of the population. He concluded by moving—"That the Administration be requested to consider, and submit to the Council early in the next session, a project for the acquisition by the City of the monopoly of the municipal gas supply." The proposition was received with cries of "Hear, hear," and "Vote;" and the Committee's proceedings were confirmed without discussion.

THE PROPOSED AMALGAMATION OF WATER-GAS COMPANIES.

The Consolidation Scheme.

In the JOURNAL for the 20th ult. (p. 1093), we gave an outline of a scheme submitted to the shareholders of the North British Water-Gas Syndicate, at their last annual meeting, and subsequently to those of the British Water-Gas Syndicate and the Yorkshire and Lancashire Water-Gas Company, for a consolidation of the three undertakings. The following further details of the proposal have since been issued: It is proposed that a call of 10s. per share shall be made from the shareholders of the North British Syndicate and of the Yorkshire and Lancashire Company; and that all claims at the instance of the British Syndicate against each of the sub-Companies shall be cancelled. These claims comprise £49,269 12s. 1d. on capital account, exclusive of interest, against the North British Syndicate, less the amounts disbursed in respect of the contracts with Messrs. Spencer and the Glasgow Iron and Steel Company, and £15,000, exclusive of interest, against the Yorkshire and Lancashire Company. The North British Syndicate has a balance of some £12,000 available cash, against which there are liabilities, other than the claims of the British Syndicate, to the extent of some £3000; and it has power to call up £2 per share on 39,940 shares, or £79,880. The Yorkshire and Lancashire Company state that they have power to call up £2 per share on 18,460 shares, or £36,920; but there is a bank overdraft of about £7000. The general purport of the proposed scheme is that the British Syndicate and the sub-Companies will transfer to the new Company the whole of their undertakings; that is to say, that all the assets and liabilities, except the further uncalled capital, in each Company (such uncalled capital being £1 per share in the British Water-Gas Syndicate, £1 10s. per share in the North British Water-Gas Syndicate, and £1 10s. per share in the Yorkshire and Lancashire Water-Gas Company), will be handed over to the new Company, who will undertake to pay all the costs and expenses of the voluntary winding up of the three Companies, which it is proposed shall follow on the necessary agreements for the transfer of the undertakings becoming absolute, and indemnify the shareholders against any further liability. It is proposed that the new Company shall have a capital of £250,000, in 250,000 shares of £1 each, of which 200,000 shares, issued as fully paid up, will be distributed among the three existing Companies; leaving 50,000 shares unissued. The British Syndicate will receive for distribution among the shareholders £115,000 in fully paid-up shares of the new Company; the North British Syndicate, £60,000 in fully paid-up shares; and the Yorkshire Company, £25,000 in fully paid-up shares. If the scheme should be ratified, the British Syndicate will waive its right to its holdings of shares in the sub-Companies.

The Secretary of the Committee of dissentient shareholders in the North British Water-Gas Syndicate (Mr. G. F. Allan) has published a letter in which he comments upon the subjects referred to in the circular lately issued by the Directors of the Company, and makes the following observations upon the advantages which they say are offered by the amalgamation scheme. "In the first place, whereas the scheme cancels the obligation for uncalled capital except 10s. per share (which will probably be immediately demanded) the dissentient shareholders refuse to pay any call. In the second place, whereas the scheme professes to get rid of the heavy claims against this Company by the parent Company, the dissentient shareholders intend to refuse to pay any balance of the purchase price of their licence. In the third place, while it professes to cancel all the shares held by the parent Company in this Company, it does not point out that these shares are deferred till 50 per cent. has been paid on the ordinary shares. In the fourth place, while it proposes to give certain shares in the new Company, it does not state whether the new Company has any process that is more likely to pay than the patents and processes of the older Company, which patents and processes have led to the loss of the shareholders' money. In addition to this point, the dissentient shareholders intend to retain the £12,000—equal to about 5s. a share; and, if so advised, to take steps to recover the money already paid as the price of the patents." He adds that since the issue of the dissentient shareholders' circular, several hundred concurrences have been received, and more are continually coming in; and it is intended, as early as practicable, to hold a meeting.

A LOOK INTO THE DISTRIBUTION DEPARTMENT.

By Paulos Thieman.

[Abridged from *Light, Heat, and Power.*]

Not long since there occurred a reunion of gas men, all of whom had been comrades in the same gas office where their careers in the business had started. In the exchange of experiences and telling of anecdotes anent gas works and offices, one item of discussion, upon which all agreed, has remained with me; and the impression has grown in force since then, as I realize its importance and the inadequate attention it receives. I refer to the conduct of the distribution department—that part which includes the laying of services, the setting of meters, the inspection and control of piping buildings, the correction of defects in supply beyond the main, the setting of stoves, and which, in its total of many operations and number of men and use of material, costs many thousands of dollars yearly—that part of the business which comes closest to the public, and whereupon depends largely the popular opinion of the company, inasmuch as it forms the active machinery of the office in the making of bills and their enforced collection, the attention to complaints, and the handling of new or changing consumers. Many a consumer bases his regard or disregard for the company upon the manner of a complaint man; and, in general, the despatch of attention to poor gas and leaks and meter setting is more noticed than the candle power of the gas. Dividing the business into four parts—management, manufacture, distribution, and counting-house—it is undeniable that distribution is of the utmost importance. Does it receive the care it merits at any gas-works? The observations of these gentlemen, some of whom have travelled widely, were to the same conclusion—an emphatic "No." The deeper they entered into the subject, the more astonishing were the incidents of neglect, ignorance, and incompetence given as witnessed, and the startling succession of places where the evil exists. The growth of this thought upon me, is the excuse I offer for this communication. If it shall serve to add, even in a small measure, to the attention due to this department and the men who have their places therein, I shall feel repaid.

If the engineer or manager who reads with discrediting eye will step into his shop and make a thorough investigation, he is likely to find meters standing with open inlets and outlets; ¾-inch pipe going into his services; meters set, and gas left on, for the gas-fitter's convenience when he finishes hanging fittings; cock connections screwed upon the ends of services without T's for alcohol openings and blowing out; services extended with elbows galore, and meters set without any fixed standard of number of lights or size of risers. By watching closely, he may see meters dumped upon the floor or thrown into a waggon like old iron. Perhaps he may find that his inspector never inspects; that services are run from one house into another; that meters are hung in coal bins, or set out of doors, under staircases, or upon the ground, or beside steam-piping and furnaces; that new buildings are tested, and months afterwards the gas is blindly turned on; that "no gas" means a change of meter, and that leaks are cemented up; that for every meter four connections are made, and two disappear; that a small service freezes every day, and is as regularly thawed out;

that pieces of pipe and fittings extra are never returned, but are left in cellars here and there; that there is not one man who will clean a stove, nor who knows anything accurate about it; that 4-hole cookers are set upon ⅜-inch drops, or are attached without stopcocks; that misread meters are "hands dropped;" that meter-readers use matches, and so on. Then let him see whether every "no gas" or leak is visited that day; how many days it takes to get in a new set; how often the consumer reports a leak afterward; how often the consumer says: "Your man came, but the gas is as bad as ever;" what proportion of leaks reported are found; how many jobs per man each day are attended to; find how many men hunt for leaks with matches; ask one or two what the scale of pipe is, and, for instance, if they have ever set meters on risers running through an open hall-way or partition walls; find if they grind in leaking or jammed cocks, or throw them into the scrap pile; ask one of the men if he ever heard of such a thing as cock grease, and if he ever used a mirror to see if he had the service-cock straight on; notice if there is any ¼-inch pipe on the rack, and if waste ends of pipe are threaded for use as nipples. Question the foreman, and see if the air is burned out on the new sets or changed meters; if the lights are tried at every point of a building after gas has been newly turned on; how long a meter dial is watched when gas is on after being turned off or on a set which is not tested at the time; if word is left why a meter cannot be set, or a consumer is notified when it is shut off; if the defect is explained properly when it is not the company's duty to remedy; if the men are instructed not to gossip with consumers; if the meter is taken away when a job is found leaking, or left there shut off for the mercies of the gas-fitter. Investigate, and I think the investigation will, at least, be worth the time, as a reassurance.

There are so many things connected with this department, that to attempt to enumerate them is a feat only to be appreciated when the attempt is made. I shall endeavour to lay down a set of rules, however, knowing that I shall no doubt miss some important item. These rules are on the principle that, a certain usage being demonstrated as wise, adequate, or economical, it shall be fixed, and that such usage is right, and any deviation from it is wrong. Unless, then, the conduct of your work practically conforms with these rules, the conduct of your department is wrong. To set my point, I will repeat that, unless a certain code is established as right, and any fitter who infringes it is liable to dismissal, then only may the engineer or manager be sure that abuses do not exist, at least from a mechanical standpoint.

The service is of the greatest importance. Nothing under 1-inch pipe should be used; and in connecting meters in no case may less than ¾-inch pipe or ⅝-inch lead be allowed. Each building must have its own service. It should come from the largest main and the shortest distance, and always straight, with unmistakeable drain. Where one meter only is set, it should extend no farther than thread enough to attach a fitting. In no case may unions be used, but always a long screw, should the service be cut. In going through masonry, the pipe should not touch the stone, but be protected by wood from the contact. Where gas-fitters are required to bring risers to the service, the latter should be run complete and ready for meters, so as to show just where the riser must come. Every foot of pipe and each fitting should be thoroughly coated. The service must always have its own trench, and never follow water services or sewers. The natural bottom of the trench must be the platform for the pipe. The employment of labourers to run service-pipe is bad, unless the work is laid out for them. An officer of the company should, in all cases of residences with lawns or store buildings, &c., designate the line of the service; it should not be left to the workmen in any particular. In running long services, the scale of pipe, as to distance, requires to be adhered to, thus: Not more than 70 feet of 1-inch, 100 feet of 1¼-inch, and 150 feet of 1½-inch pipe. The sizes of pipe must be according to risers, thus: One 1¼-inch, two 1-inch, five ¾-inch risers would be 230 lights, and require a 2½-inch service.

The inspector should see the fitting of every building before lathing and plastering. Unless the work is seen, through notice by gas-fitter, the gas should never be turned on. The scale of pipe should not be deviated from, and nothing less than ¾-inch risers allowed; ⅜-inch and ½-inch pipe should be prohibited. All risers to be brought into the cellar, or ground floor if there is no cellar, and extended to the service; ⅝-inch openings count as 2 lights, ½-inch as 6, ¾-inch as 20. Thus, a ⅝-inch pipe may have one opening only besides a kitchen or hall light, which counts as one; or one opening and a bracket—brackets counting as one. Brackets must always come from below. The lengths must be adhered to, thus: 50 feet of pipe must be ¾-inch, if in continuous line, even if the openings number for ½-inch pipe—*i.e.*, 30 feet of ½-inch, and 20 feet of ¾-inch pipe. No riser should be brought down in partitions of open staircases, or in walls projecting beyond store fronts. All lines of pipe must run square, in nowise diagonally, and must be set into notches of the joists. Unconcealed pipe only may be run underneath. Traps should not be allowed under any circumstances.

All meters from 20-light up are properly connected with iron pipe cut to measure. It is a surprise to me that meter manufacturers do not screw 20-light meter liners, and upwards, for iron pipe. The convenience and advantage would be great. The use of various lengths of lead is a matter of choice; but more than 18 inches should not be employed. For 3-light meters, ⅝-inch lead and ¾-inch cocks; for 5-light meters, ¾-inch lead and 1-inch cocks; for 10-light meters, 1-inch lead and 1¼-inch cocks. Above that comes iron pipe and service-cocks, which should be the same as the riser.

In setting meters, the men are to be held answerable for any deviation from a fixed scale in ordinary cases; and on large jobs the foreman or superintendent should designate. A meter should be calculated, under a 15-10ths pressure, to accurately register three times its rate, thus: A 5-light meter, 15 burners. The scale should be: Residences with 15 burners or less, 3-light (supposed to light not more than 10); 20 to 25 burners, 5-light; 30 to 40 burners, 10-light; 50 to 80 burners, 20-light. Stores should be set in strict accordance with the ratio of twice the rate, where the lighting is constant; otherwise, with the ratio of three times. Theatres, hotels, &c., should be twice the rate of meter, at least. If the consumers' ledgers of any large company are examined, it will be quickly apparent that thousands of dollars are wasted in meters unnecessarily large; and, in many cases, no plan or rate will be found carried out. On old jobs the same size is set back; and if the meter was, to begin with, too small or too large, it is carried out to the end. Two out of three large dry meters, after one year's constant service, will show from 10 to 30 per cent. error; but how often are they changed? A large meter will also contain considerable water without interfering with the flow of gas; and every inch of water in the diaphragms is so much gas lost to the consumer. Large meters should be changed and emptied every six months, and at least each year; and small meters each three years. In size of meters, it is better to err in having them too large than too small; but it does no cost any more to have them right. It rather saves thousands of dollars for large works.

Meters should never be set in an open cellar, or close to a furnace or steam-pipe, nor upon the ground or in the damp. No meter should be taken from the shop which is not intactly painted, nor which has not been tested. The meter-fitter should use the least number of fittings, and always leave an opening at the end of the service by using a T-piece; otherwise the meter must be disconnected to thaw out or blow out the service. A meter ought not to be set beside a coal opening or barrel shoot; and to place it under an outside staircase is heinous. The meter forms a receptacle for all the condensation out of the house-pipe; therefore every gas-fitter should be required to place on each riser a Y fitting with a stopcock. By this means, whenever the water is sufficient to overflow into the meter, the gas is cut off; and, upon opening the cock, the water is freed, and the gas reinstated. This may be done by the consumer. Running risers up to the first floor from the cellar, forming a dead trap, is not permissible. Places for meters are rightly considered with a view to convenient access; but it is better to have a meter-reader begrime himself, which costs the company nothing, than to place the meter where it is unworkmanlike. Placing meters inside apartments, or where they may be locked up, preventing access, must not be allowed without special permission from the superior of the meter-fitter. In no case should the man deviate from the fixed law without reporting the case for instructions. If the lights are tried and the job found obstructed, the meter must just as stringently be disconnected as if a leak existed.

Setting two meters by the use of T's upon one ¾-inch opening should be prohibited; nor should more than one meter go on extended ¾-inch pipe. Setting meters on an extension from under a show window into the room, to be kicked and sat upon, is wrong. Risers must always be found connected by pipe of the increased size, and opening accordingly, and the opening at the lowest point. If risers supply more than the consumer's premises, the gas should not be turned on without notifying him. The meter-fitter must consider any defect in the service the same as in the house-pipe and report. The spread of the service for meters should be in its straight line. The use of crosses to run smaller pipe away from it should not be permitted. Where it rises from the point of entrance, a T must invariably be used of the same size as the service, so that a wire with a brush may be inserted if necessary.

The use of more fittings than are absolutely required or any formation not adhering to the straight flow of gas, when it may be avoided, should be reprimanded and stopped; the flattening of connections, likewise. Every defectively made connection should be reported. The joint should be so well "sweat" in by iron as to withstand a severe strain which is to be applied to every connection. The unions of small meters should be screwed down by pliers, not with the wrench.

It is right and best to visit leaks upon the mere report, even if it may be in the house-pipe. If in the house-pipe, and, by noticing the meter, they prove of consequence, the man should shut off the gas and inform the consumer, who will then turn it on upon his own responsibility. The searching for leaks in cellars or under show windows should be done by the hands, or by sense of hearing or smell. If the leak is palpable to the smell, and the man cannot find it, another man should be despatched and the leak found. If found in the meter, this must be exchanged; and the spot marked or indicated by a tag for the meter-repair man. If in the connection, it should be replaced—never left cemented or caulked by pliers. If a washer has shrunk, a new one should be inserted—not merely the union tightened.

In answering a complaint of poor gas, the lights should first be tried. When it is not during cold weather, and it is palpably a case of condensation in the service, then the meter should be disconnected at the outlet; and if the flow is all right, the consumer ought to be notified, and, if possible, taken to the meter. The defect in a house-pipe, if apparent, it is well to point out to him. The presence of water is too clear a symptom to be mistaken. Every service found to contain water should be recorded as a trapped service, for overhauling. However, the blind relaying of trapped services when the calls have not become fair to a repetition, is an unwise expenditure.

Water in a service should always be dealt with by the service-cleaner; and, in cases of naphthalene, the men should be required to give a fixed number of shots by the pump with benzene or gasoline, followed up by the use of the swab. A brush upon a wire is the only thorough way of cleaning a service. Of course, the treatment of naphthalene in services requires the removal of the connections, and the attention of the expert foreman or superintendent. Continual freeze-ups likewise require this personal attention. The use of brine is entirely vicious. Good alcohol should be employed, and the employment of a certain quantity should be required; otherwise it is wasted. In cases where a rapping upon the riser may dislodge an obstruction, or a leak may be temporarily repaired, in the house-pipe, or in any case, where the consumer may be pleased by a few minutes' work, the men should be instructed to comply with requests.

Where the complaint men are sent to collect bills or disconnect gas, they should be instructed to engage in neither altercation nor discussion. The workmen are employed to work, not to talk, which the company provides competent men to do. Where the service-cock may not be employed, it is better to insert a cork in the inlet, or soap the core of the meter-cock, than remove the connections. No meter should be left with one side open, but be plugged pending turning on or removal, either of which should not be delayed. The removal of the meter where the account remains unpaid should be immediate. In no case where the street-cock cannot be used should the connections be left on. The service should be plugged or capped; otherwise a bit of hose will be an easy means of stealing gas.

Unless the men are stringently watched, they will leave services on, and shut off the gas at the cock connections. How many men look back into the box to see if the cock is fully turned on? They never do it, unless the rule is enforced. I have known services to be dug up for stoppage which would be found to consist of a partly turned on stop-cock. A man who will turn on in the street, where he cannot enter a house, is a dolt on a par with the man who will rush into a burning building to rescue a meter valued at $5. No gas should be turned off without the man, after so doing, informing the consumer. It is best to have a printed form, and let the man fill in the date and the reason for the discontinuance, and leave it on the premises. It is well to use such a form in cases where meters may not be set, stating the reason. The meter-reader should be confined to noting complaints or stating the index. Stopping to figure the bill in dollars or cubic feet is wrong, and should be prohibited. The route-book should be changed about each month. All practice has made patent that the employment of any other than complaint hands or company's men for inspecting meters is bad. The indexer should be competent to note any defects or disarrangements in the jobs on his route; and by this means alone can their workmanlike condition be maintained. The use of matches and candles by meter-readers is utterly wrong.

Every company should be able to set a small meter on the day it is registered for, if before the noon hour. If necessary, a meter should be set at the latest moment. No more ought to be required than issuing the order. During cold weather, all companies should be able to answer every complaint on the very day or night of its receipt. I do not say it *should* be done in these cases; I assert that the company should be able to do it without any scurrying or appeals, or additional pay to men. Further, the taking of meter statements should not interfere with the complaint department. Any company which confesses an inability to set meters or attend to complaints because of the meter taking, confesses to a defect in its management somewhere. Every intelligent man about the works or in a street gang who is active enough, and who can be spared for a few days, should be trained as a reader of meters, and used. I can brand the student and boy system of statement getting as dangerous and stupid. The employment of "handy" men, or men who have not served their time in a gas shop, is worse. Require a man to be a professional, pay him commensurately, and then pin him squarely to every iota of time and accuracy. A man of this kind is worth three handy or cheaply picked-up men. That some companies are not mulcted time after time for damages because of incompetent men, is mere good luck, like the proverbial escape of the intoxicated.

The applauding of men for entering burning structures to remove meters is thoughtless. If the building is to be saved, the firemen require the gas to light them through the smoke. If the fire is beyond control, it is useless to try for the meters. It is only proper when a district or row is threatened, and the loss in meters will be heavy, or when many meters are in a building. A man injured or killed while under orders, or tacit orders, to rescue a 3-light meter, will cost the company thousands of dollars. If the fire seems liable to reach the service, then the gas should be shut off in the street.

Are your drips pumped out at stated times? Have you a map of the drips in the shop? Do you keep a man, or men, on duty after six o'clock during the winter months? Can you call your men on short notice at night or on Sundays? Do your men drop everything, and quit at 5.30 or 6 o'clock p.m.? Have you a man who can rebuild a stove? Is the gas-fitting in your own shop and your office a model of accuracy and neatness? Were yesterday's important orders all attended to?

The Proposed Purchase of the Runcorn Water-Works by the Improvement Commissioners.—On the 18th inst., a meeting of the shareholders of the Runcorn, Weston, and Halton Water-Works Company was held, for the purpose of considering the proposed purchase of the water-works by the Runcorn Commissioners. Mr. J. Brundrit presided, and stated that the Company was formed in 1865, and water was first supplied in January, 1870. According to the census of 1871, the combined population of Runcorn, Weston, and Halton was 14,770; but the last return showed that the population had increased to 23,944. It was necessary to provide a further supply; and the Commissioners then broached the subject of purchasing the works. Negotiations had been going on for some time, and a Bill was to be introduced into Parliament. The object of the meeting was to sanction the manner in which the transfer would be made. A resolution was passed approving of the Bill; and a second, giving the Directors powers to vary the terms of the agreement for the sale, was also adopted.

Beyrout Water-Works Company, Limited.—The annual meeting of this Company was held on Tuesday last, at the London Offices, 17, King's Arms Yard, E.C. Mr. J. Morris presided. In moving the adoption of the report, he stated that there had only been a slight increase in the revenue; but this was due to some extent to the cholera in Syria. Fortunately it had not been so desolating as in previous visits; but as soon as there was an outbreak, people left the place, and this, of course, affected the Company's receipts. The Directors were still hoping to get an extension of the concession, which was of vital importance to the shareholders; but it was one of those things which they could not press. They nearly obtained an extension a short time ago; but some evil-disposed person, who had a grievance against the Company, took upon himself to go to Constantinople and stir up discord, and the authorities did not see their way then to proceed with the matter. The Directors would not take any hasty steps; but they did not despair of getting a prolongation. With regard to the accounts, the gross revenue for the year amounted to £12,633, against £12,474; being an increase of £159. After making proper allowances for proportion of cost of new machinery and depreciated value of stores, and carrying £1000 to reserves for contingencies, a net balance remained of £6480. Mr. Andrew seconded the motion. Replying to a question, the Chairman said, if they could get an extension of the concession, and laid out a little more capital in improving the service in various ways, he thought thefuture of the Company woul d be more hopeful. The report was adopt ed; and the retiring Directors (Messrs. J. Staniforth and G. N. Souratty) and the Auditors were re-elected.

RICHMOND CORPORATION WATER SUPPLY.

Local Government Board Inquiry.

On Wednesday, the 11th inst., Mr. T. CODRINGTON, M.Inst.C.E., one of the Inspectors of the Local Government Board, held an inquiry at Richmond in regard to two applications made to the Board by the Corporation of that borough, one of which was for sanction to the borrowing of £7300 for works of water supply.

The TOWN CLERK (Mr. F. B. Senior), in addressing the Inspector in support of the latter application, said that, on the occasion of the previous inquiry, which was conducted by the late Mr. J. Thornhill Harrison, the sum asked for was £3500; and the information which had been supplied to the Local Government Board showed in detail what had been done since. There was a balance of £575 12s. in hand from the last loan; and the amount needed in excess of this, to complete the adit connecting the two wells, was £726 12s. Then there was a proposal to extend some of the other adits; and for the work incidental to this the Corporation asked for £1500. The receipts on account of water supply amounted now to £11,000, which was a great increase on those for 1891; while the purchase of water from the Southwark and Vauxhall Company had fallen off—the sum paid by consumers being only £1278 last year, as against £2649 in 1891.

Mr. *W. G. Peirce*, the Water Engineer of the Corporation, was then called. He stated that they had only 195 feet to bore to complete the long adit; and the cost of the work would be about £1 14s. per foot. He produced plans showing the new adits it was proposed to drive, and gave evidence as to the estimates.

The INSPECTOR asked what proportion of the water obtained came from above the chalk. In 1890 it was given as 120,000 gallons; and 70,000 gallons were said to come from the adits. In April, 1891, the quantity of water obtained from the former place was reported to be 51,000 gallons; and from the adits, 58,000 gallons.

Witness said that on June 9, 1891, they had 69,000 gallons of water from the chalk; whereas on Feb. 9, 1892, it was 83,360 gallons. But there had been a dreadful falling off, as they now obtained only 19,000 gallons a day. The average flow during the preceding five weeks had been about 165,000 gallons, of which 146,218 gallons came from the adits. The daily supply to the town was now 478,687 gallons.

The TOWN CLERK remarked that out of this quantity something like 94,500 gallons were used on the roads. This left 384,000 gallons, of which 165,700 gallons came from the Terrace Garden well.

Mr. *W. B. Bryan*, M.Inst.C.E., Engineer of the East London Water Company, said he was familiar with the water-works at Richmond, and generally approved of them. Great advantage would accrue from the completion of the long heading. They would have extra storeage; and there would be the possibility of getting more water and having another shaft, at which Mr. Peirce proposed a little later to put duplicate pumping machinery. The latter would enable them to pump for 12 hours only instead of 24, and would do away with the expense of two stations. The total storeage of the adits would represent about 500,000 gallons. It would be a great advantage and economy to secure the thorough ventilation which the completed heading would afford. The extra driving would tend to increase the supply of water. There was a big fissure, from which water was bubbling up with a fair amount of pressure from under the floor. The dip of the fissure was very considerable; but the beds of flint were horizontal. With regard to the prospect of getting more water, it was always difficult to say how much would be obtained from a well. They might grope about for a long time, and then get it or miss it. At one well belonging to his Company, they drove 1000 feet of an 8 ft. by 8 ft. 6 in. adit 120 feet beneath the surface of the chalk, and did not get any water. They abandoned the adit, came 60 feet higher, and began afresh. It was for a long time extremely depressing to get no water; but he was pleased to say that they were now drowned out. This was from about 62 feet below the top of the chalk. In addition to the big adit, where they did not find any water, they had put down bore-holes to a depth of 560 feet, and none of these yielded a supply. They had sunk a good many other wells. At Waltham Abbey they drove a 12 ft. 6 in. shaft perfectly dry for 50 or 60 feet, and then struck into a fissure that gave upwards of 1,000,000 gallons daily. From bore-holes they obtained 1,000,000 to 1,500,000 gallons per day. The water had risen 140 feet on the pumps; and they could not lower it. It required sometimes an enormous amount of perseverance to get at these underground waters.

Mr. *W. A. Valon*, M.Inst.C.E., the Gas and Water Engineer of the Ramsgate Corporation, and Engineer of the Westgate and Birchington Water-Works, generally confirmed the opinion expressed by the previous witness as to Mr. Peirce's proposals. He said he had made a careful examination of the works. Much more water seemed to be coming in towards the head of the long adit than at its commencement. The chalk was very close at the beginning. The south adit, again, was cutting a fissure in the chalk at right angles; and there could not be much doubt that it was the right thing to follow this up. Going for water underground was quite a lottery; but he had a very strong conviction that at Richmond they were proceeding in the right direction, and that they might at any moment come upon an excellent supply. Sometimes he had gone through a heading and seen no indication of water, and a few feet farther had found a good flow.

The TOWN CLERK then gave details of the proposed extension of mains; and stated that money was also required for meters and service covers. More pipes were needed for the sewer-flushing system, as the road-water main did not extend to all the required points. It had been a great saving of the reservoir water. They had no reservoir for this purpose, but pumped into a dead main, with a small hydraulic valve or engine showing the pressure per inch. They found they had quite sufficient pressure at fires, even at the highest part of the town. The double service had been found most invaluable at fires. Some 4-inch main was required; but it was chiefly 3-inch and 2-inch.

The INSPECTOR advised that the 2-inch main should be altered to 3-inch throughout. This was agreed to, though it was stated that the extra cost of pipes and fittings would be about £300.

During the inquiry a number of more or less irrelevant questions were put by a member of the Council.

THE NEW WATER-WORKS FOR MANSFIELD.

Local Government Board Inquiry.

The question of providing an increased supply of water for Mansfield (which has occupied the attention of the Town Council for a considerable period) formed the subject of an inquiry by Major-General Phipps Carey, R.E., one of the Inspectors of the Local Government Board, on Wednesday last. Mr. Appleton appeared in support of the application which the Council have made for sanction to borrow £25,000 for new works; and he opened the proceedings by giving a brief outline of the history of the water supply of the town. The old Water Company was constituted in 1870, with a capital of £12,000 in 1200 shares of £10 each. In 1888 numerous complaints were made in respect of the insufficiency of the water supply. The opinion of Mr. Rofe was taken by the Company as to whether the supply could be augmented from the existing works; and this was found to be impracticable. In 1888 the Improvement Commissioners entered into negotiations for the purchase of the undertaking, which at the time proved abortive; but in 1889 the purchase was completed, at a cost of £19,850. Complaints were still made as to the insufficiency of the supply; and the Commissioners consulted Mr. Hodson, who was instructed to propound a new scheme. He found it impossible to augment the supply from the existing works; and he accordingly carefully inspected the district, with a view of establishing a new scheme. The supply from the present works was from 248,000 to 250,000 gallons; and the amount from the new works would be nearly a million gallons per day. The Town Clerk (Mr. R. J. Parsons) was the first witness examined. He stated that he was Secretary of the Water Company from its establishment, and gave particulars of the purchase of the undertaking by the Commissioners. A provisional agreement, he mentioned, had been entered into between Lord Savile and the Council for the purchase of the necessary land. He declined (in cross-examination by Mr. Botterill, who represented the Ratepayers' Association) to express any opinion as to whether or not the price given by the Improvement Commissioners for the Company's works was a fair one. The Medical Officer (Dr. Wills) and the Borough Surveyor (Mr. R. F. Vallance) gave evidence as to the insufficient supply, both in regard to quantity and quality. Mr. Hodson said he was consulted by the Improvement Commissioners in 1888 as to the best means of improving the water supply of the town. After a careful survey of the district, he made borings for water at Rainworth. A sample of the water obtained from the Bunter pebble bed formation was sent to the late Dr. Tidy for analysis; and his report was that the water was magnificent for manufacturing and domestic purposes, and he congratulated any town on having such a supply. He (Mr. Hodson) formed the opinion that it was one of the finest sites for obtaining a water supply, particularly for a manufacturing town, of any in the midland counties. Mr. Botterill stated the case for the opposition at some length. He said the chief objection of the Ratepayers' Association to the scheme was that it involved the abandonment of the present works, which had been working tolerably satisfactorily since their construction. His clients quite agreed that the time had come when a further water supply must be obtained for the town; but they thought Mr. Hodson's scheme extravagant. Another objection to the scheme was that it was undertaken without the advice of a professional geologist having first been obtained, and that it would have a bad effect upon the development of coal-mining in the district by interfering with the water supplies of Farnsfield, Blidworth, &c. Among the witnesses who appeared on behalf of the opposition were Mr. W. R. Dalton and Mr. H. Bonser, C.E. Great interest was taken in the proceedings; a large number of ratepayers being present.

THE POSITION OF THE LEEDS CORPORATION WATER UNDERTAKING.

An interesting article appeared in a Leeds contemporary last week describing the Corporation water-works, and giving some figures as to the magnitude. It appears therefrom that the area of the Washburn watershed, from which Leeds obtains its water supply, is 21,552 acres, representing a length of 13¼ miles, and a breadth of 6 miles. The gross daily capacity of the Washburn watershed is 32,000,000 gallons; but from this 10,000,000 gallons per day must be allowed for compensation water, leaving the net daily capacity of the watershed 22,000,000 gallons. Adding to this the net pumping power at Arthington, makes the total available water supply for Leeds 28,000,000 gallons per day. There are four storeage reservoirs—Fewston, Swinsty, Lindley Wood, and Eccup—and the following particulars as to their size and holding capacity were given:—

	Length. Yards.	Breadth. Yards.	Depth. Feet.	Capacity Mill. Galls.
Fewston . . .	2267	667	47·0	866
Swinsty	1933	933	55·1	960
Lindley Wood . .	2400	367	57·6	750
Eccup	1967	733	62·3	1331·52

The total number of acres of water in the storeage reservoirs is 624, representing 3907·52 million gallons, which is equal to 186 days' supply, with compensation provided for as well, should there be no more rain for that period; and this apart from the fact that 23 feet of the depth at Eccup reservoir is not available. The distribution of the water to the various houses in the borough is effected by means of two 30-inch gravitating-mains from Swinsty to Eccup, which are capable of delivering 12,000,000 gallons per day; one 30-inch pumping-main from Arthington to Eccup, which is capable of delivering 3,500,000 gallons per day; and one 24-inch pumping-main from Arthington to Eccup, which is capable of delivering 2,500,000 gallons per day—or a total delivering capacity of 18,000,000 gallons per day. The gravitating-mains are each 13 miles long; and the pumping-mains are each 4 miles long. A table is next given showing the annual and daily average consumption of water during the past ten years. In the year ending Aug. 31, 1883, the gross consumption was 3,097,000,000 gallons; the average per day being 8,485,000 gallons. Each year (excepting 1888) there was a gradual increase, until, in the twelve months ending March 25 last, the consumption reached 4,804,096,250 gallons; being a daily average of 13,107,930 gallons. The works at the Arthington pumping-station are only used as an auxiliary to the gravitation supply from the Washburn; and the Corporation have legal power to pump 6,000,000 gallons per day from the River Wharfe, or in lieu 6,000,000 gallons per day from the foot of Washburn. The latter is done; the water being led in a 27-inch main to the pumps at Arthington, which raise the water for a height of 260 feet into the Eccup reservoir; and the pipes through which the water is pumped are one 30-inch and one 24-inch. The pumping-station at Headingley is for pumping water from the low-level gravitating supply to the high-level districts. The water to supply these pumping-engines is brought down from the filter-beds at Weetwood to the station at Headingley by an 18-inch main, and is pumped by them into two high-level service reservoirs, one situated at Moortown and the other at Bramley. There are four engines—(1) 30-horse power, water pumped in 24 hours 720,000 gallons; (2) 10-horse power, water pumped in 24 hours 322,560 gallons; (3) 30-horse power, water pumped in 24 hours 576,000 gallons; (4) 30-horse power, water pumped in 24 hours 576,000 gallons—total, 2,194,560 gallons. The quantity of water lifted at the Headingley pumping-station for the supply of the higher level districts during the year was 508,890,300 gallons, which is equal to an average consumption of 1,390,350 gallons per day in these districts. But, in addition to the requirements of the town itself, water has been delivered outside the borough to the following extent: Morley, 136,780,000 gallons; Rothwell, 19,758,000 gallons; Oulton and Woodlesford, 17,709,000 gallons; and Seacroft, 5,977,000 gallons—or a total in all of 180,224,000 gallons, which is an average daily consumption of 493,764 gallons. The service reservoirs (which fill during the night and during the day, and maintain the pressure so as to give a proper supply to the districts remote from the heart of supply) are situated at: Moortown, which has a holding capacity of 680,300 gallons; Bramley, with 1,486,900 gallons; Wortley, with 840,739 gallons; Woodhouse Moor, where the capacity is 5,142,228 gallons; and Beeston, which holds about 56,000 gallons. The total quantity of water sold by meter for trade purposes within the borough during the year was 1,048,882,000 gallons; and the returns for the past ten years show an increase of nearly double the quantity, while there is no doubt that the increase in the consumption of water by meter for manufacturing purposes still continues.

NEW YORK WATER SUPPLY.

The Croton Aqueduct Dam.

In the JOURNAL for the 27th ult., reference was made, in the course of the paper lately read by Mr. G. F. Deacon, M.Inst.C.E., before the Liverpool Engineering Society, to the great masonry dam at Lake Vyrnwy. It may therefore be interesting to reproduce from the *Railroad Gazette* the following particulars in regard to the Croton Aqueduct dam of the New York Water-Works, as compared with two other dams lately constructed in India.

After nearly ten years of agitation and discussion, the final and essential features of the plans for the new water supply of New York from the Croton River have been approved, and the work has been put under construction. The contract for the storeage reservoir dam at the intake of the new aqueduct has been awarded to Messrs. James S. Coleman Co., the lowest bidders for the work, the cost of which, as estimated by the engineers, was to be $4,574,820, and as proposed to be built by the contractor, $4,150,573. The violent opposition which was made to the construction of this work, and which has been the cause of the great delay in beginning it (for it ought to have been begun simultaneously with the construction of the aqueduct itself), has been, in some respects, probably of benefit to the city, and certainly has been the occasion of a more thorough elucidation and illustration of the principles governing the construction of great masonry dams than could otherwise have been obtained. Nearly every engineer of any prominence in hydraulic work and masonry construction has had something to say on the matter—some through official reports called for by the authorities in charge of the Croton Aqueduct, some retained by opponents of the Commissioners' plans, and a not inconsiderable number of volunteers, several of whom propounded theories as extraordinary as they were novel.

In one respect the opposition and delay have been disadvantageous, in that they have caused the location of the great dam to be changed from the original site of Quaker Bridge, suggested by Mr. B. S. Church, the originator, as it is believed, of the aqueduct scheme, and for some years the Chief Engineer of the Aqueduct Commission. The very name "Quaker Bridge Dam" has become so odious to the opponents of the project, that it was deemed advisable to dispense with it entirely, and go farther up stream to a point in many respects less advantageous for the purposes of the storeage reservoir which was needed, and for the construction of a dam, but which nevertheless gave opportunity for the creation of a sufficiently capacious reservoir, and for the construction of a dam of somewhat less cost. The site, selected after careful examination by Mr. Alphonse Fteley, the Chief Engineer of the Aqueduct Commission, is known as the Cornell site. The dam to be built here will unquestionably be an imposing structure in appearance. Viewed from below, there will be seen on the right bank of the river an earth embankment 500 feet in length, extending from the hillside to a point where it is about 100 feet high. Continuing straight across the valley, there will then be a masonry wall 600 feet long, and of a general height of 150 feet above the valley. From the end of this wall, and extending down stream nearly at right angles to the line of the dam, there will be a wall of masonry 1000 feet long, and from 150 to 5 feet in height—the face of the wall being built in steps; and over this wall the waste water from the reservoir, when filled to overflowing, will fall in a foaming cascade. Æsthetically this dam will not be a great success. The long spillway on the left will doubtless present a very beautiful appearance when the water is flowing over it, which will be for perhaps a few weeks in the course of the year; but

the combination of masonry and earth, and the general rectangular lay-out of the whole concern, will have more of the characteristics of a mill-dam than of a great engineering structure.

As regards the most important feature of the work, the section of this masonry wall, which from the top of the rock at the bed of the stream will be about 225 feet high, and will have to sustain the pressure of 167 feet of water, it is interesting to compare the final results reached by the Chief Engineer with those of other engineers who have given attention to the subject of masonry dams.

It is hardly worth while to examine all the various plans which have been suggested for this dam, nor the plans of dams which have been built for several years. It will suffice to compare the section of the Cornell dam with the sections of three others—two of them recently constructed in India by English engineers, and only about half the height of the Cornell dam, and the third being the one suggested for the Quaker Bridge dam by Messrs. Davis, Croes, and Shunk, the Board of Experts appointed by the Aqueduct Commission in 1888 to consider the question.

For the first 100 feet in depth below the water-level, which is as far as these four sections can be properly compared, as two of them extend but little beyond that height, the differences of section are very marked. At 100 feet below the water-level, the Bhatgarh dam is 65 feet thick; the Cornell dam and the Quaker Bridge dam, proposed section, 74 feet thick; and the Tansa dam, 87 feet thick. At the level of the water in the Croton reservoir, the Tansa dam is 17 feet thick; the Bhatgarh dam, 15 feet thick; the Cornell dam, 19 feet thick; and the Quaker Bridge section, 28 feet thick.

With reference to this great excess of thickness in the plan proposed by the Board of Experts, it appears to have been caused by the introduction into the calculations of the question of pressure exerted by ice forming on the surface of the reservoir. In the Indian dams, of course, no such question had to be considered. The final conclusions of the Chief Engineer of the Croton Aqueduct appear to have been that the question of ice pressure was not worthy of consideration; and consequently the dam is to be built with a thickness, at the ordinary water-level, of only two-thirds of that recommended by the Board of Experts in 1888. At 200 feet below the ordinary level of the water, the Cornell dam is 180 feet in thickness, as against 160 feet recommended by the Board of Experts. The sectional area of the two plans for 200 feet in height does not differ materially. One difference lies in the distribution of the material; the Board of Experts preferring to place the maximum resistance to extraordinary forces at the top of the dam, and the Chief Engineer putting them at the bottom. As regards the horizontal plan, the straight line adopted by the Chief Engineer is undoubtedly the cheapest in construction, but it probably will not satisfy the extreme theorists on either side; one set holding that an arch curving up stream is the best, as affording some slight possibility of arch action, and another set claiming that the toe pressures and liability to overturning would be diminished by having the concave side of the arch opposed to the water. However this may be, New York is sure of having its great water supply scheme from the Croton completed in its entirety by a structure which will be a credit both to its designers and to the city.

Additional Filter-Beds at the Worcester Corporation Water-Works.—The Worcester City Council at a recent meeting adopted a recommendation of the Water and Sewerage Committee that three new filter-beds (containing together an area of 2226 square yards) should be constructed, at an estimated cost of £4500. Application is to be made for the sanction of the Local Government Board to a loan of the above amount, repayable in 30 years.

The Electric Light in the British Museum Reading-Room.—The following letter, written from the Athenæum Club, appeared in *The Times* last Friday: "It surely is time that steps were taken to light the British Museum Reading Room more efficiently than at present. An hour seldom passes without one or other of the lamps going out, and so plunging many students into semi-darkness; while the loud and continuous hissing made by all of them is a serious interruption to steady work."

Electric Lighting for Kingston—The Kingston Town Council passed a resolution, on the 5th inst., authorizing the Electric Lighting Committee to obtain tenders for an installation of plant to supply electricity to 5000 private incandescent lamps and to 30 or 40 arc lamps for street lighting, in accordance with a specification to be prepared on lines suggested by Mr. W. H. Preece, and empowering them to take the necessary steps to obtain sanction to the borrowing of £16,000 for the purpose.

German Competition in Steel.—A Wolverhampton correspondent of the *Standard*, writing early last week, stated that great surprise had been created in Staffordshire upon its becoming known that the Germans are sending steel into the centre of England at prices against which native workers cannot compete. It appears that steel plates for gasholder making and engineering purposes, and steel rods for rivet, screw, and wire making, are coming over at prices which Staffordshire and Mid-England steel makers cannot accept other than at a considerable loss. It is said that the exceedingly low through Continental rates allowed by the railway companies, makes this remarkable competition possible.

The Buffalo (N.Y.) Water Undertaking.—By the charter of the city of Buffalo (N.Y.), the term of the Water Commissioners expired on the 1st inst., and the Commission now cease to exist; the plant being turned over to the Board of Public Works. The average quantity of water pumped daily has increased twelve times since the city bought the plant in 1868; and the present works are valued at $8,000,000. The local press attributes a considerable part of the increase of population, from 55,000 to 300,000, during the city's ownership of the plant, to the liberality of the Commissioners in extending the water facilities and to low rates, which have proved an inducement to manufacturing industries. In the 24 years which have passed since the purchase, the rate has been reduced for domestic consumers 54 per cent., and for meter consumers 58 per cent.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The report of the famous deputation from the Edinburgh Town Council to the cities of the South, to inquire into electric lighting, which they have been hatching for a fortnight, has at last seen the light of day. It is a very pretty essay upon electric lighting, with a few remarks appended as to what is being done in the places visited; but the particulars are of such a hotch-potch nature, that nothing can be learned from them. The report might have been written by Mr. Murray, the expert clerk, without leaving his rural retirement in Biggar, or by any of the deputation who may have a knowledge of electric lighting matters. No information is given upon which a ratepayer who might be anxious to make up his mind as to whether he should allow his representatives in the Council to vote away his money upon electric lighting could do so. Neither the cost per mile, nor per lamp, is vouchsafed; and it is nowhere stated what the increased charge would be upon a consumer who might contemplate giving up gas lighting and taking to electricity. True, in the case of Oxford, it is stated that "the relative cost of street lighting is: Gas, £172; electricity, £385." The word "relative" is not explained; and it is impossible to say whether it is lamp for lamp or light for light, or whether it is simply the difference in the charge upon the Corporation for the lighting of a certain area. For a preliminary report, upon a subject in which the community are as much interested as the Corporation, the document appears about as unbusinesslike a production as could well be conceived. The deputation are not prepared, at this stage, to give a preference to any of the systems they saw. They are of opinion that the system most suitable for Edinburgh can only be selected after a careful consideration of the sites available for a central station or stations, and the area to be supplied therefrom. In other words, they have no mind on the subject, and will have to pay somebody to find one for them. They learned that "experience has shown that electric lighting is not likely to prove profitable until the second or third year, as many consumers only apply after they have seen the light used by more enterprising neighbours." This sentence should have read that it was impossible to tell whether a corporation electric lighting installation would be profitable or not until the end of the fourth year; because the contracts with consumers being for three years, it could not be said till then how many would renew for a second term. The deputation "were very strongly advised by those municipal authorities with whom they came in contact to work the Electric Lighting Order themselves, and not to hand it over to a company." To be sure. It is much easier to work an installation "economically," as they term it, when the rates can be fallen back upon, than if a company had it in hand, who would require to make ends meet. A corporation can supply current to a consumer at a cheaper rate than a company; but it is a question for the public whether everybody should be taxed to supply a few with the light. The report comes before the Town Council on Tuesday. It will likely be sent to the Lord Provost's, or a Special Committee, to determine which system is to be adopted. To do that, an expert will be called in; and the announcement of his name will, to those in the know, at once fix the system. It is a pity that the deputation have not, in their report, given an estimate of the cost, irrespective of a site for works, of the different systems; so that the public might see for themselves the burden which will be laid upon them. The public ought to have some voice in the selection of what they will have to pay for.

I learn that a representative of the *Glasgow Herald* has this week visited Peebles for the purpose of writing a descriptive article upon Mr. W. Young's oil-gas plant, which may appear on Monday. It is satisfactory to know that the plant is standing the test of practical working, and continues to give the results which were reported in the JOURNAL after a month's trial. During December, the gas supplied was of 30-candle power; and the cost was about 4d. per 1000 cubic feet cheaper than it was in the previous December, when a lower illuminating power was supplied. Some idea of the effect which the invention will have on the oil industry may be had from the statement that, were all the oil produced in Scotland utilized in gas manufacture, it would only suffice to raise the illuminating power of the gas produced in the whole of the United Kingdom by one candle. This should revive the drooping spirits of the holders of oil shares. Of course, it is not to be expected that Mr. Young's system will be introduced into all the gas-works in the kingdom; but even far short of that would raise the demand for oil, and, with the advantage to the gas industry above stated, it is likely that the system will be very extensively adopted. I understand that since attention was called to the invention in the JOURNAL, Pebbles has become quite a Mecca for gas engineers and managers; and Mr. Young and Mr. Bell are both kept busy showing the plant at work to all who call.

The difficulty between the Inverness Police Commissioners and their contractor for the construction of a gasholder tank, came before the Commissioners on Monday. A long report by the Law Agent was submitted, in which he pointed out that, in the specification for the excavation and building of the tank, it was stated that the contractor would require to keep the pit clear of water until the building was of such a height that there would be no difficulty with the water. Then, in the specification for the ironwork, it was stated that the Commissioners would keep the pit clear of water during the erection of the tank and gasholder. There was no acceptance of either of the offers for work—the signing of the formal contracts being the only acceptance given. In the contract for the construction of the tank, it was stipulated that the contractor should keep the whole of the excavations clear of water during the operations of the contractors for the tank and gasholder, until the work had been performed to such a height as would obviate any difficulty or danger on account of water; the Engineer to be sole judge of when such height was attained. The Law Agent reported that the contractor for the tank was made well aware of the contents of the formal contract before he signed it. His opinion, therefore, was that the Arbitrator should abide by the contract and not the specification. It was moved that the contract should be adhered to; and that the question of the extra remuneration of the contractor should be left open. This proposal did not find favour, because

the Commissioners have no power to give extra remuneration; and the Commissioners sent the subject back to the Arbitrator to be dealt with as he sees fit, without expressing an opinion. Of course, the Arbitrator will see the opinion of the Law Agent, and will be guided by it.

Mr. A. MacPherson, of Kirkcaldy, has been the Consulting Engineer in extensive alterations which have just been completed upon the gas-works at Newburgh, Fifeshire. The retorts have been built on an improved setting of Mr. MacPherson's devising; and a tower scrubber has been erected. He was congratulated by the Directors of the Gas Company on Thursday, on the success which had attended his work. The gas was tested; and it was found to be greatly improved in the matter of purity, and of 27-candle power. When he was present, Mr. MacPherson, always obliging, gave the Directors some valuable instruction as to how to burn gas to advantage—a subject upon which he is well qualified to speak.

It has been given out frequently of late that the Irvine Town Council are considering whether they should introduce electric lighting for the streets of the town. They have, indeed, gone so far as to take down a distinguished scientist, who has advised them that they can have a 50-horse power water-wheel to drive dynamos. There is said to be a reason for everything; and I have discovered the reason for this Corporation coquetting with the electric light. It is explained by an interview which Provost Armour and a number of his colleagues in the Town Council had on Tuesday with the Directors of the Gas Company, at which the latter were asked to re-consider their decision to advance the price of gas from 3s. 9d. to 4s. 2d. per 1000 cubic feet. Ex-Provost Paterson, the Chairman of the Gas Company, disposed of the request of the councillors by pointing out to them that the price of gas in Irvine had been, since 1883, lower than in Ayr and other towns of similar size. In Ayr, it is 4s. 2d., with an annual charge of 1s. 6d. for hire of meter, which is not made in Irvine. The Directors would do nothing in the meantime; but the representations which had been made to them would be considered in July. If not satisfied with the reply, the councillors ought to be at least gratified by the suavity of the Chairman.

The Glasgow water supply is being about doubled; and the work has not been at all too soon gone about. Not only has the population greatly increased of late years, but, on account of the general enforcement of sanitary regulations, a much greater supply of water is required. In connection with this, a very grave danger was mentioned at the Town Council on Thursday, by Mr. Ure. The Council have laid down, under their Act of 1890, regulations which require a certain type of water-closet to be employed; and the complaint is made, by the Health Committee, that there is an insufficiency of water to flush the closets. The consequence is, as Mr. Ure said, to transfer the nuisance from the outside to the inside of the houses. A remit was made to the Water Committee to consider whether more water cannot be given. Another incident which shows the straits to which the Water Committee are put, arose in connection with the water supply to Springburn, the most northerly and most elevated district of Glasgow. The high-level reservoir at Cockmuir supplies a population of 18,740, by means of a 12-inch main. There are, in addition, other 7500 people who get their water chiefly by gravitation, but who require an hour's pumping a day to meet their requirements. In this hour 65,000 gallons are pumped. The supply is not sufficient; and the suggestion was made that the pumps should be kept going for another hour. It was, however, pointed out that, if this were agreed to, the water supply of other parts would suffer, and that nothing could be done till the new mains from Craigmaddie were completed. It is satisfactory to know that there is abundance of water in Loch Katrine for the supply of Glasgow, if the distributing plant were equal to the demands upon it.

We have received from the Convener of the Hamilton Gas Commissioners (Mr. W. Brown) a letter referring to a paragraph in our correspondent's "Notes" on the 10th inst., in which, he says, it is made to appear that the increased yield of gas per ton of coal recorded at the Hamilton Gas-Works is wholly due to the settings of retorts erected according to Mr. Henderson's arrangement. He explains, in justice to the Manager (Mr. W. Ewing) and to Mr. Henderson, that twelve retorts were set according to the latter gentleman's system, eight of which are in use. To these, some alterations have been made; and they are now, Mr. Brown says, giving complete satisfaction. At the same time, 36 retorts, old and new, were in use, which were not on Mr. Henderson's plan; but with the improved methods of working, on both old and new settings, the present satisfactory results have been attained.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 21.

Sulphate of Ammonia.—The improvement in the market is well maintained; but it seems strange, in view of the large business doing, the advance in prices is not more pronounced. To-day's values show at the most 5s. per ton rise since the end of the year; and this circumstance furnishes sufficient evidence to indicate that the upward movement is unpalatable to nearly all the buyers, whether dealers or consumers. It remains to be seen how far this resistance can be carried; but meanwhile shipments are heavy and stocks are diminishing. There are buyers at all the ports now at £10 5s.; but makers generally hold for an advance. Nitrate is very firm at 9s. 3d. per cwt.

LONDON, *Jan.* 21.

Tar Products.—The chief feature in this market is the undoubted improvement both in the demand and price of tar acids. Whether this is due to the extremely low prices to which they had fallen having tempted buyers to come in, or the cholera scare, or the revival of their use for explosive purposes, it is not at the moment easy to say. The fact remains that an extensive business is being done at the improved prices fixed by the Tar Products Sales Committee. These increased values are a considerable benefit to the Lancashire and the Midland distillers; but, as there is only a small quantity of tar acids in the London and east-coast tars, it is of little advantage to the distillers in these districts. Benzol is in the anomalous position of having improved in price without much business being transacted. Aniline makers declare that the prices quoted are out of all proportion to the value of aniline. Whether aniline can be brought up to the parity price of benzol, or whether benzol will fall to the parity price of aniline remains to be seen. Anthracene continues firm; but very little new business is reported, excepting that The Gaslight and Coke Company have realized the convention prices for the lot they are offering. Pitch is firm in the provinces; but the London market is in a vacillating state, owing to the large quantity of Beckton make being offered. Tar is a little better; and higher prices are being paid. Business has been done at the following prices: Tar, 12s. 6d. to 14s. Pitch, 27s. Benzols, 90's, 2s. 1½d.; 50's, 1s. 10d. Toluol, 1s. 6d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 9½d. Creosote, 1¼d. Creosote salts, 18s. Carbolic acid, 60's, 2s. 4d.; 70's, 2s. 8d.; crystals, 7½d. Cresol, 1s. 10d. Anthracene, 30 per cent., "A," 1s. 1d. nominal; "B," 9d. nominal.

Sulphate of Ammonia.—This market continues to improve, and important business has been done at prices ranging between £10 3s. 9d. and £10 6s. 3d., according to position and conditions of delivery. It is expected that higher prices yet will be seen. Gas liquor is quoted at 6s. 9d. to 8s. delivered to buyers' works.

COAL TRADE REPORTS.

Lancashire Coal Trade.—In the coal trade of this district, the better qualities, suitable for house-fire purposes, continue in fairly active request; but no pressure for supplies is experienced, and it is exceptional where collieries are working more than five days per week. Prices continue to be firm, at late rates. Best Wigan Arley averages 12s. to 12s. 6d.; Pemberton four-feet and second qualities of Arley, 10s. 6d.; and common house-fire coals, about 8s. 6d. per ton. With regard to the lower qualities of round coal, these continue extremely difficult to move; and prices are very low—7s. per ton at the pit mouth being about an average figure for ordinary descriptions of steam and forge coal. This continued extremely depressed condition of common round coal, must necessarily have some effect upon prices, when the usual gas-coal contracts come upon the market. Last season, prices had to give way from the same cause; and it would seem very probable that further concessions will have to be made this year. Only a quiet demand still comes forward in the shipping trade; and very low prices are quoted to effect sales at the ports on the Mersey. Common steam coal is readily obtainable at 8s. to 8s. 3d. per ton; with the better qualities quoted at about 8s. 6d. to 8s. 9d., delivered at the Garston Docks or the High Level, Liverpool. Engine classes of fuel still move off fairly well. Prices average 6s. 3d. to 6s. 9d. for good qualities of burgy; 4s. 9d. to 5s. 3d. for the better qualities of slack; 4s. to 4s. 6d. for medium sorts; and about 3s. 3d. to 3s. 6d. per ton for common descriptions, at the pit mouth.

Northern Coal Trade.—There has been a fall in the demand for coal in the past few days; and prices are easier all round. Some Continental ports have been closed to trade by ice; and this, with the lessened consumption of gas coal, has had an effect on the general demand. Best Northumbrian steam coal is quiet. The price is from 8s. 9d. to 8s. 10½d. per ton f.o.b.; while second-class steam coal is about 9d. per ton less. Small steam coal is weak, at 3s. to 3s. 3d. per ton. Bunker coal is very depressed, as was to have been expected when the large numbers of idle steamships is remembered; and with full supplies, the price is weaker, varying from 6s. 6d. to 7s. 6d. per ton. Gas coal is still in very large demand; and the production is well taken up generally—though one or two producers have had to accept lower prices, to enable them to keep their collieries fully at work. Prices for best gas coal vary from 6s. 6d. to 7s. per ton f.o.b.; but two producers ask a little higher price. Coke has been sold in fair quantities for export at 15s. per ton; gas coke is unaltered in price. It is believed that application will soon be made for reductions of wages in the Northern coal trade, preliminary meetings of the coalowners having been held.

Scotch Coal Trade.—In Scotland, the coal trade is very flat. Forward buying is scarcely in existence; and what business is being done, is mostly from hand to mouth. A large firm of coal owners in Lanarkshire is understood to have orders on hand which will only serve for a week or so. Fife coal is reported on offer in the West at 6s. 3d. per ton. The Association price is 6s. 9d.; and the cut by Fife coal is attributed to the closing of the Baltic outlet. Steam coal is particularly weak, on account of the many steamboats which are laid up. Prices are much the same as last week—viz., main, 6s. 9d. to 7s.; ell, 7s. 6d. to 7s. 9d.; splint, 7s. 9d. to 8s.; and steam, 8s. 9d. to 9s. The exports during the week amounted to 100,482 tons—an increase of 42,180 tons upon the preceding six days, but a decrease of 1739 tons as compared with the corresponding week of last year. For the year to date, there is a decrease of 10,252 tons.

The Quantity and Quality of the Gas at Leeds.—The Gas Committee of the Leeds Corporation (says the *Yorkshire Post*) has just decided to continue for another three months the experiment of making gas from coal costing so much less than cannel that, according to Alderman Gilston, £18,000 a year may be saved. This decision was arrived at by the Committee at their meeting last Thursday; but it is understood that the members were by no means unanimous upon the matter. On the one hand, the Chairman, and those who side with him, are anxious to relieve themselves of the stigma of having sacrificed £13,000 by their penny-wise-and-pound-foolish policy last year. But, on the other hand, the outcry of deficiency of light and ever-fluctuating pressure has been pouring in from all parts of the borough ever since the use of "cheap" coal was resorted to. The Corporation desire the Gas Committee to supply gas of 19-candle power; yet all through the past six months, the gas distributed through the town has not reached a higher average than 18·5 candles.

The Gas Question at Accrington.—With the payment by the Accrington Corporation and other Local Authorities of the full amount of the gas bills, sent in by the Accrington Gas and Water Company, the difficulty may now, writes our local correspondent, be said to be settled. It is significant, however, that the action of the Company in raising the price of gas by 5d. per 1000 cubic feet between the readings of the meters, has led to the Corporation and other bodies joining hands for the purpose of opposing the Bill of the Company in the ensuing session.

High Carbonizing Record at the Rochdale Road Gas-Works, Manchester.—Last Thursday was a noteworthy day at the Rochdale Road Gas-Works of the Manchester Corporation, inasmuch as the largest quantity of gas ever made there was reached. The day production was 4,497,000 cubic feet; the night, 4,712,000 cubic feet—together, 9,209,000 cubic feet. This was at the rate of 9902 cubic feet per ton of coal, and 8289 cubic feet per mouthpiece. Out of the total number of retorts at the station (1134), 1111 were at work—817 on four-hour, and 294 on five-hour charges. This station, our readers may remember, is under the management of Mr. G. Ernest Stevenson, M.Inst.C.E.

Remission of the Damages and Costs in the Ward Slander Case.—At a meeting in support of the Gas Workers' Union held at Belvedere last Friday evening, Mr. W. H. Ward, the General Secretary, gave a description of his trial and imprisonment in connection with his slander action. During the course of his narrative, he said he desired to give Mr. George Livesey credit for a very generous act. Mr. Livesey had given him a clear receipt in settlement of all claims for the damages and costs obtained against him; and he (Mr. Ward) could not help repeating that this was not only an unexpected act, but it was a very generous one. The speaker then dealt with the general prospects of the Union, which he contended were satisfactory.

Para Gas Company, Limited.—In the report to be presented to the shareholders of this Company at the ordinary general meeting next Monday, the Directors state that the accounts for the half year ending Sept. 30 last show, as compared with the corresponding period of 1891, an increase in the amount received for public lamps and illuminations, but a falling off in the revenue from private lighting and most other sources of income. The expenditure was unusually heavy, partly owing to the necessity for erecting a new holder. During the six months covered by the report, the rate of exchange fell to 9 7/16d.; but after August there was a partial recovery. The low rate injuriously affected the private lighting, as it necessitated increased payments in currency. The Directors recommend the usual dividend on the preference shares.

The Morley Corporation and the Laying of Mains in the Mytholmroyd Local Board's District.—In the Chancery Division of the High Court of Justice last Friday, before Mr. Justice North, the Mytholmroyd Local Board sought to restrain the Morley Corporation from laying down pipes and mains in the district controlled by the Board, without, as was alleged, complying with certain statutory provisions, which required them not to open highways under the superintendence of the Board, except with the consent of, and according to plans approved by them. Mr. Cozens Hardy, Q.C. (with whom was Mr. Waggett), who appeared for the plaintiffs, stated that it was admitted that the Corporation had acted without consent; and accordingly their Counsel conceded that there must be an injunction to restrain them from so doing in the future. There was this further point: The Corporation had opened roads and laid down many pipes; and they would undertake to furnish the Board with plans showing where these pipes were, and to execute any alterations in the works already carried out which the Board's Surveyor might reasonably require. Mr. Methold, for the Corporation, assenting, an order was made in accordance with the terms arranged between the parties, and providing for payment by the Corporation of the costs.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 136.)

Issue.	Share	When ex-Dividend.	Dividend on Dist. Bonds.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	11—12	..	6 5 0
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12	..	13 6 8
200,000	5	16 Nov.	7½	Bombay, Limited	5	5⅞—6⅛	..	6 0 0
40,000	5	,,	7½	Do. New	4	4—4¼	..	6 13 4
380,000	Stck.	12 Aug.	12½	Brentford Consolidated	100	212—217	..	5 12 10
150,000	,,	,,	9½	Do. New	100	165—170	+2	5 8 9
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sept	11½	British	20	41—43	..	5 6 11
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½—15⅝	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	7½—8⅛	..	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	99—101	..	5 18 10
150,000	20	12 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	14 Oct.	13	Commercial, Old Stock	100	236—241	+4	5 7 8
165,000	,,	,,	10	Do. New do.	100	180—185	..	5 8 1
160,762	,,	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	120—125	..	3 12 10
800,000	Stck.	15 Dec	13	Continental Union, Limited	100	226—231	+4	5 12 6
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190—195	+3	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	20—21	..	4 15 3
354,060	10	,,	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,820	Stck.	12 Aug.	12	Gaslight & Coke, A, Ordinary	100	225—230	+1½	5 4 4
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	262—267	+1	3 14 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 7
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	166—171	..	4 7 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	165—169	+2	4 2 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	261—266	+1	3 15 1
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	153—157	+1	3 16 5
1,061,150	,,	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	120—123	+2	3 5 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	125—130	+2	3 9 3
908,000	,,	,,	6	Do. 6 p. c. do	100	165—170	..	3 10 6
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	225—230	+4	5 4 4
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4—4⅛	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	107—109	..	4 11 9
541,920	20	16 Nov.	5	Monte Video, Limited	20	14½—15⅛	..	6 9 0
150,000	5	30 Nov.	10	Oriental, Limited	5	8—8¼	..	5 17 8
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4⅛	..	7 7 4
166,870	10	—	2	Pará Limited	10	2—2¼	..	—
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	100-105	..	5 14 3
150,000	10	—	10	San Paulo, Limited	10	8¼—9⅜	..	—
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	289—294	+1	5 5 4
1,350,000	,,	,,	12	Do. B do.	100	238—243	+1	4 18 9
230,000	,,	,,	13	Do. C do.	100	245—250	..	5 4 0
725,000	,,	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	140-143*	..	3 10 0
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	252—257	+7	3 18 0
1,720,252	Stck.	14 Oct.	8	East London, Ordinary	100	210—214	+5	3 14 10
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	141—144	..	3 2 6
700,000	50	15 Dec.	8½	Grand Junction	50	106—110	+1	3 17 2
708,000	Stck.	12 Aug.	11	Kent	100	281—286	+6	3 16 11
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	230—235	+9	4 0 10
406,200	100	,,	7½	Do. 7½ p. c. max.	100	195—199	+2	3 15 5
285,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	123—128	..	3 2 6
500,000	100	12 Aug.	12½	New River, New Shares	100	327—332	+2	3 13 1
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132—135	..	2 19 8
902,300	Stck.	15 Dec.	6¼	S'thwk & V'xhall, 10 p. c. max.	100	164—169	+7	3 16 11
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	145—150	+5	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	247—252	+4	3 19 5

*Ex Div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

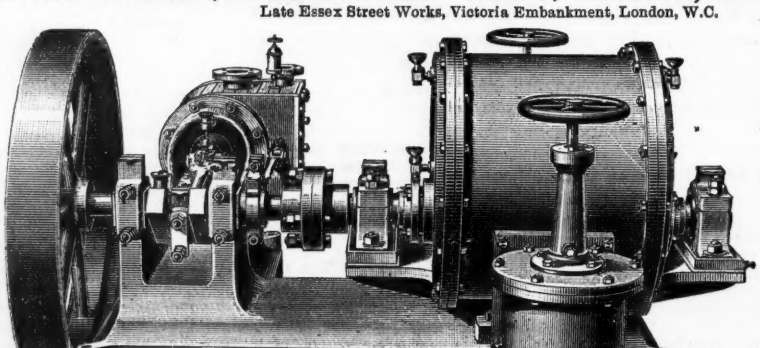
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 189, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham ouse, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

ADVERTISER (aged 33), Whitworth Scholar, with many years' experience in the Design, Erection, and Management of Gas-Works, having recently terminated an engagement abroad, desires EMPLOYMENT.
For references, &c., address, No. 2182, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AGENT wanted for the Sale of our well- known GAS CONSUMPTION REGULATORS.
Those introduced to Gas-Works, &c., should apply by letter to A. BEHL AND CO., Quedlinburg a/H., GERMANY.

LANCASHIRE TAR PRODUCTS.

CAPITALISTS and Tar Distillers are invited to JOIN the ADVERTISER in buying existing Works, erecting new ones, and FORMING A COMPANY.
Wanted an experienced CHEMIST and MANAGER.
Apply to C. DASNIERES, 16, Philpot Lane, LONDON, E.C. (Twenty-two years' connection in the Tar Trade.)

WANTED, a thoroughly practical Man as ASSISTANT ENGINEER. Must understand Gas-Works Construction, be used to travelling, and have a good connection with Provincial Gas Companies. Salary, £200 to £250 per annum.
Apply, by letter only, enclosing testimonials, to the GAS LIGHTING IMPROVEMENT COMPANY, LIMITED, 18, Devonshire Street, Bishopsgate, LONDON.

CITY OF BIRMINGHAM.
(WATER DEPARTMENT.)

APPOINTMENT OF SECRETARY.

THE Secretaryship of the Department having become vacant by the resignation of Mr. Thomas Starkey, the Water Committee are prepared to receive APPLICATIONS from Candidates for the Office.
The Secretary will be expected to be responsible under the Committee for the general management of the Undertaking (including the keeping of the Accounts), with the exception of such matters as relate purely to the Engineering Department.
Salary, £600 per annum.
Applications, stating the age and previous experience of the Applicants, and enclosing Testimonials, must be sent to the Town Clerk, Council House, Birmingham, on or before the 11th day of February next, endorsed "Secretaryship, Water Department."
By order,
EDWARD ORFORD SMITH,
Town Clerk.
Council House, Birmingham,
January, 1893.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. IV., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

PATENTS, DESIGNS, AND TRADE MARKS.

INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
Apply to J. C. CHAPMAN, Chartered Patent Agent, 70, Chancery Lane, LONDON.

WANTED, a good active steady Stoker.
Abstainer preferred. Wages 28s. per week; with Sunday Labour when required, 32s.
Apply, stating age with references, to JOHN A. HARRIS, Manager Gas-Works, WIGSTON.

WANTED, a Man, who is well ac- quainted with North Staffordshire, to take a District in REPRESENTING a Firm of COAL and CANNEL CONTRACTORS. He would be required to arrange buying and selling, and to take general supervision in that District—say, within a radius of 50 miles of Stoke-on-Trent. Must be well known to Gas Engineers.
Address No. 2177, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Offers of Muriate of Ammonia (crude and refined), and all other Ammonia and Tar Products.
RINAU-KESSEL AND CO., Cologne, GERMANY.

WANTED, particulars of small new or second-hand FILTERING AND PRESSING PLANT for ANTHRACENE.
Address W. A. PLUMBE, Chemical-Works, MANSFIELD.

WANTED, a good second-hand Centre- VALVE (dry preferred) for four Purifiers, 12-inch Connections.
State price and particulars to the MANAGER, Gas-Works, NEWTON AYE, N.B.

WANTED, to Purchase at once, Two or Three TANK-WAGGONS, suitable for the carriage of Tar.
Apply, by letter, to No. 2181, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Rectangular Station Meter.
Capacity 19,000 cubic feet per hour; 12-inch Connections.
For particulars apply to W. E. PRICE, Gas-Works, HAMPTON WICK.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

GLASGOW CORPORATION GAS.

TENDERS FOR STATION METERS.

THE Glasgow Corporation Gas Com- missioners are prepared to receive TENDERS for Two STATION METERS, to be erected at their Dawsholm Gas-Works.
Plans and Specification can be seen, and Forms of Tender obtained, at the Engineer's Office, 45, John Street, Glasgow.
Sealed offers, marked "Tender for Station Meters," to be addressed to the Subscriber, and lodged with him on or before Tuesday, the 7th prox.
The Commissioners do not bind themselves to accept the lowest or any tender.
J. D. MARWICK,
Town Clerk.
City Chambers, George Square,
Glasgow, Jan. 19, 1893.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Wareside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

GAS PURIFIERS FOR SALE.

THE Cleckheaton Local Board invite TENDERS for the purchase of Four PURIFIERS, 14 ft. square by 4 ft. 6 in. deep, with the Covers, Grids, and Lifting Gear, which they are about to replace with larger ones.
Tenders, suitably endorsed, stating lump sum offered at the Works, to be deposited with the undersigned before Four o'clock p.m., on Tuesday, the 31st inst.
By order,
J. ARMITAGE,
Clerk.
Town Hall, Cleckheaton,
Jan. 18, 1893.

THE Widnes Corporation are prepared to receive TENDERS for the supply of FIRE-CLAY, CLAY RETORTS, BLOCKS, and BRICKS.
Specifications and Forms of Tender may be obtained from Mr. Carr, Gas-Works, Widnes.
Tenders, endorsed "Fire-clay Goods," to be addressed to the Chairman of the Gas Committee, and delivered to the undersigned not later than the 6th of February prox.
The Corporation do not bind themselves to accept the lowest or any tender.
H. S. OPPENHEIM,
Town Clerk.
Town Hall, Widnes
Jan. 12, 1893.

ULVERSTON LOCAL BOARD.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the supply of RETORTS, BRICKS, and FIRE-CLAY GOODS during the Year ending the 25th of March, 1894.
Specifications, Quantities, and Forms of Tender can be obtained from the undersigned.
Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Retorts, &c.," to be delivered not later than the 2nd of February, 1893.
The Committee do not bind themselves to accept the lowest or any tender.
JNO. SWAN,
Engineer and Manager.

IMPERIAL CONTINENTAL GAS ASSOCIATION
(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is hereby given, that an Extra- ORDINARY MEETING of the Proprietors of the Imperial Continental Gas Association will be held at the City Terminus Hotel, Cannon Street, in the City of London, on Thursday, the 9th day of February next, at 2.30 p.m., for the purpose of CONSIDERING the PROVISIONS of the BILL now before Parliament, entitled "A Bill to Extend the Borrowing Powers of the Imperial Continental Gas Association." At such Meeting the said Bill will be submitted for the consideration and approval of the Proprietors.
Dated this 24th day of January, 1893.
R. S. GARDINER,
Secretary of the Association.

In the matter of the Companies Acts, 1862 and 1867, and in the matter of the Kirton-in-Lindsey Gaslight and Coke Company, Limited.

NOTICE is hereby given, that the Creditors of the above-named Company are required on or before the 20th day of February next, to send their NAMES and ADDRESSES and the PARTICULARS of their DEBTS or CLAIMS, and the NAMES and ADDRESSES of their SOLICITORS if any, to Valentine Poole Palmer, of Kirton-in-Lindsey, in the County of Lincoln, Accountant, the Liquidator of the said Company; and, if so required by notice in writing from the said Liquidator, are, by their Solicitors, to come in and prove their said Debts or Claims at such time and place as shall be specified in such notice, or in default thereof they will be excluded from the benefit of any distribution made before such Debts are proved.
Dated this 17th day of January, 1893.
B. HOWLETT AND SON,
Solicitors to the above-named Liquidator.

CAST-IRON PIPES.

THE Directors of the Otley Gas Company are prepared to receive TENDERS for the supply of 3500 to 4000 yards of CAST-IRON PIPES of 8, 9, or 10 inches diameter. Price to be quoted delivered at Otley Railway Station.

For further particulars, apply to
G. W. LUPTON, Manager.

THE GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at this Office on Friday, the 3rd day of February next, at Twelve o'clock Noon precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 31st day of December last, and to elect Directors and Auditors in the place of those who will, at such Meeting, go out of office in compliance with the Company's Acts or Schemes of Amalgamation.

By order,
JOHN ORWELL PHILLIPS,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Jan. 17, 1893.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Bridge House Hotel, London Bridge, in the Borough of Southwark, on Wednesday, the 15th day of February next, at Two o'clock in the afternoon precisely, to receive the Directors' Report and Accounts of the Company for the Half Year ended the 31st of December last; to declare a Dividend; and to elect two Directors and one Auditor in the place of those retiring by rotation.

Notice is hereby also given, that at such Meeting the Directors will submit a RESOLUTION to the Proprietors for authority TO RAISE £250,000 FURTHER CAPITAL by the creation and issue of New Ordinary Stock and Debenture Stock, pursuant to the Powers contained in the Company's Acts of 1876 and 1882.

The Transfer Books will be closed from the 1st day of February until after the Meeting.

By order,
FRANK BUSH,
Secretary.

Offices: 709A, Old Kent Road, S.E.,
Jan. 23, 1893.

NOW READY.

GAS AND WATER CO.'S DIRECTORY, 1892.
Sixteenth Annual Issue, 5s.

GAS-WORKS STATISTICS, 1892.
Fourteenth Annual Issue, 3s. 6d.

WATER-WORKS STATISTICS, 1892.
Twelfth Annual Issue, 2s. 6d.

Handsomely Bound in One Vol., Price 10s.

LONDON: HAZELL, WATSON, & VINEY, Ltd.,
1, CREED LANE, E.C.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

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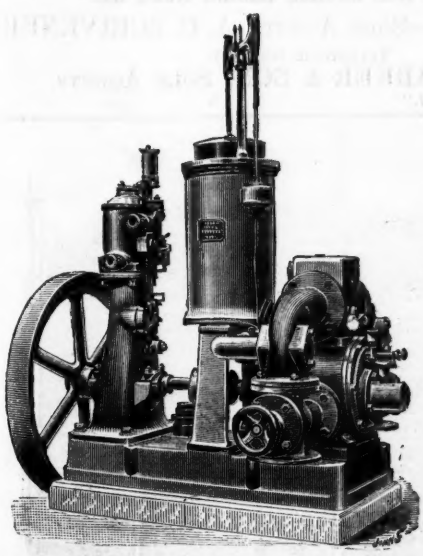

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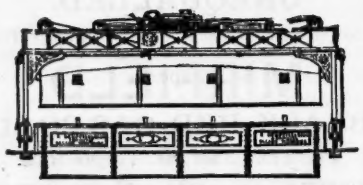

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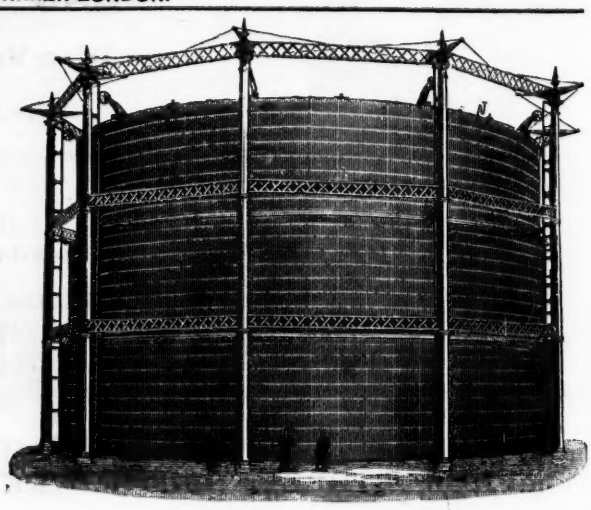

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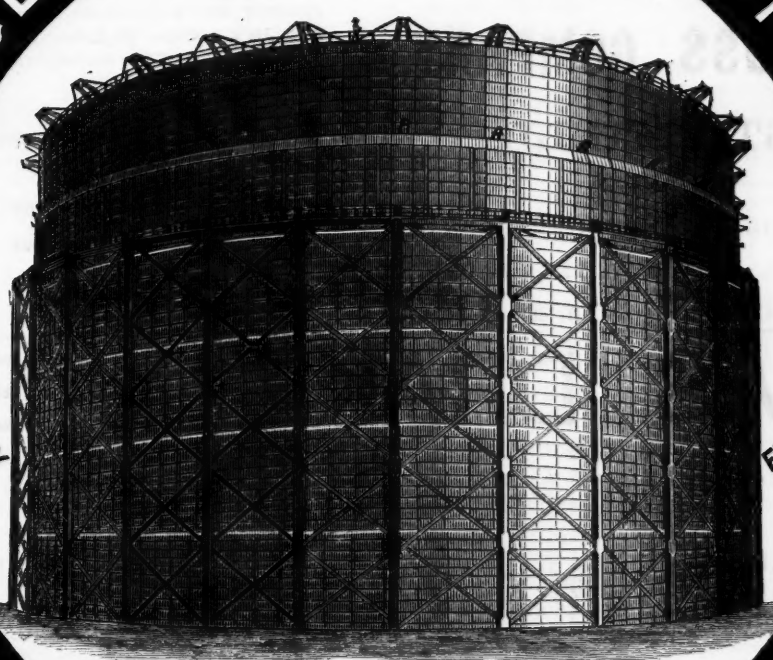

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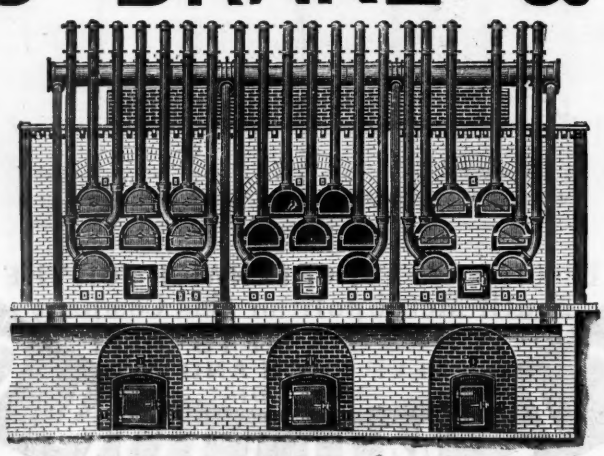

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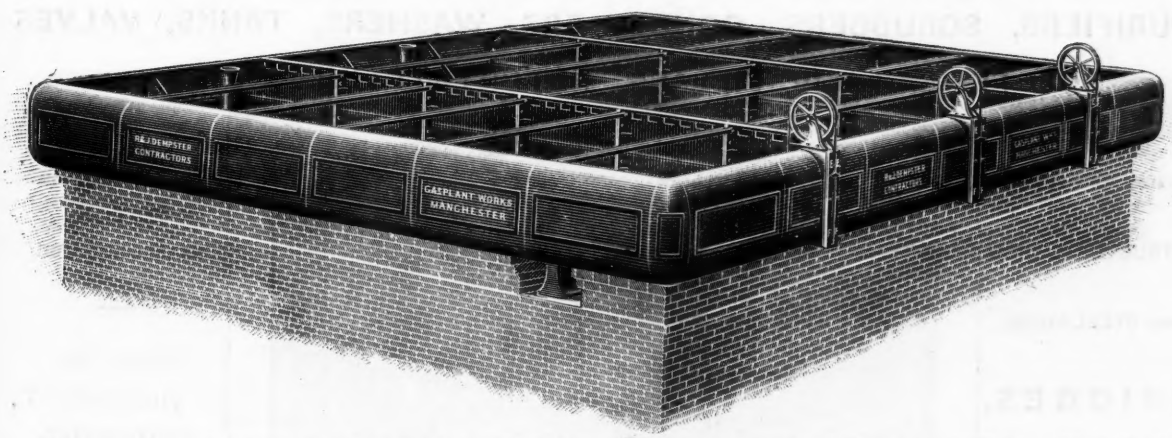

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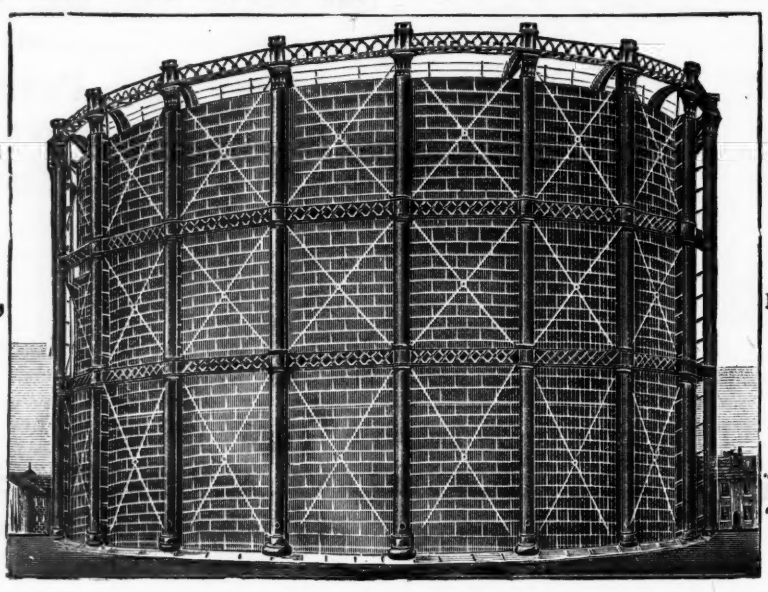

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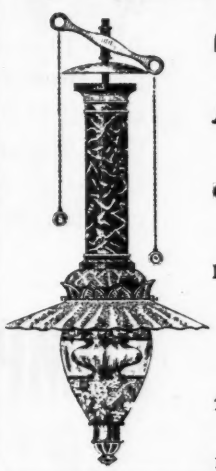

THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— **55/-**
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
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Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

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LAMPLIGHTERS' TORCHES.
PROPRIETORS AND MANUFACTURERS OF
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PUTTYLESS STREET LAMP.
This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

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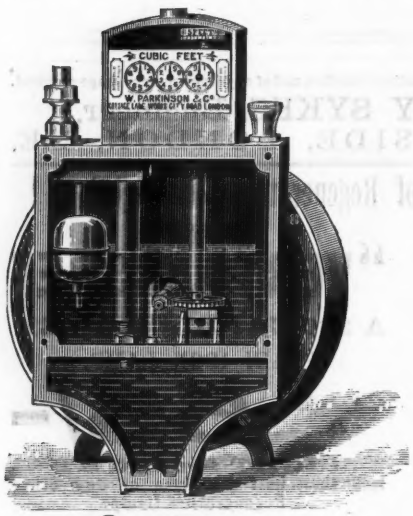
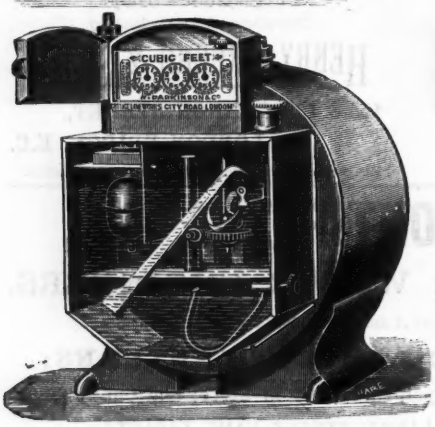
THE ORIGINAL MANUFACTURERS OF WET METERS.



ORDINARY WET METERS

IN CAST-IRON CASES.

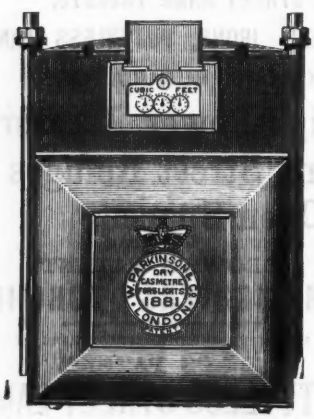
Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.



COMPENSATING METERS

IN TINNED OR CAST-IRON CASES.

The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.



DRY METERS.

These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected and the brasswork and smaller fittings are of superior workmanship.

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Telegraphic Address: "PRECISION."
[See Advt., also p. 132.

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